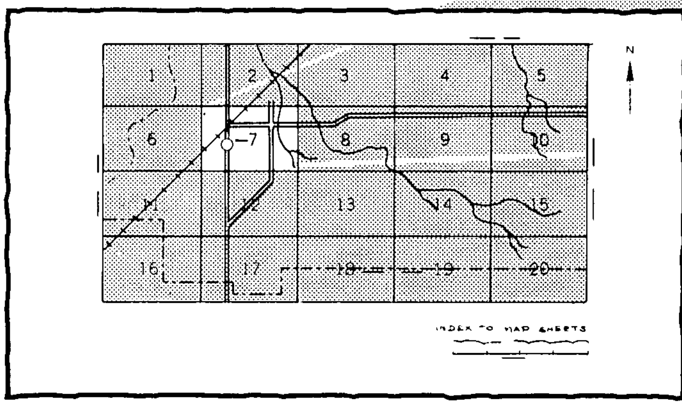
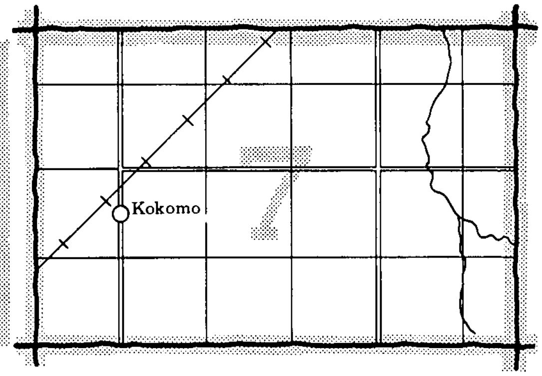
SOIL SURVEY OF
Sterling County, Texas

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

HOW TO USE

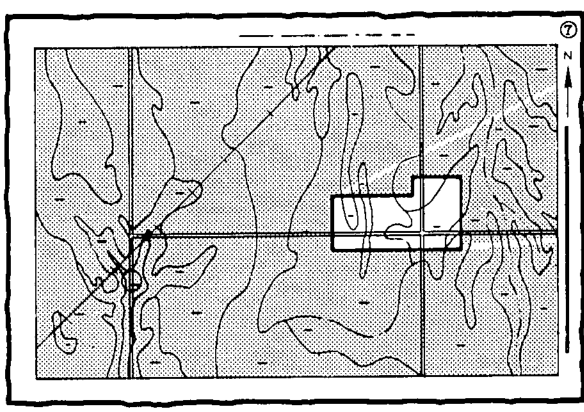
1. Locate your area of interest on the ''Index to Map Sheets'' (the last page of this publication).

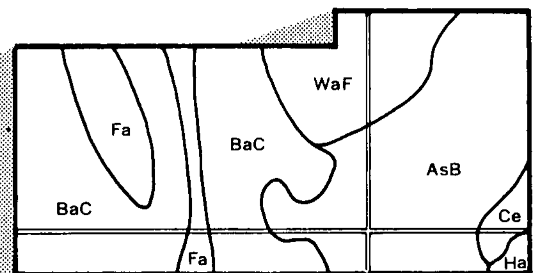




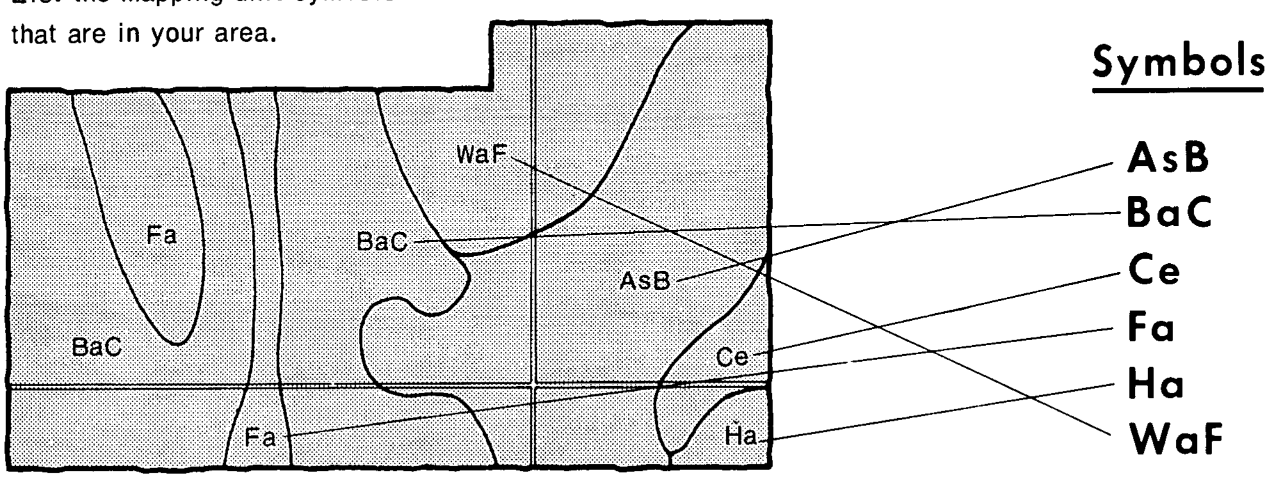
2. Note the number of the map sheet and turn to that sheet.

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



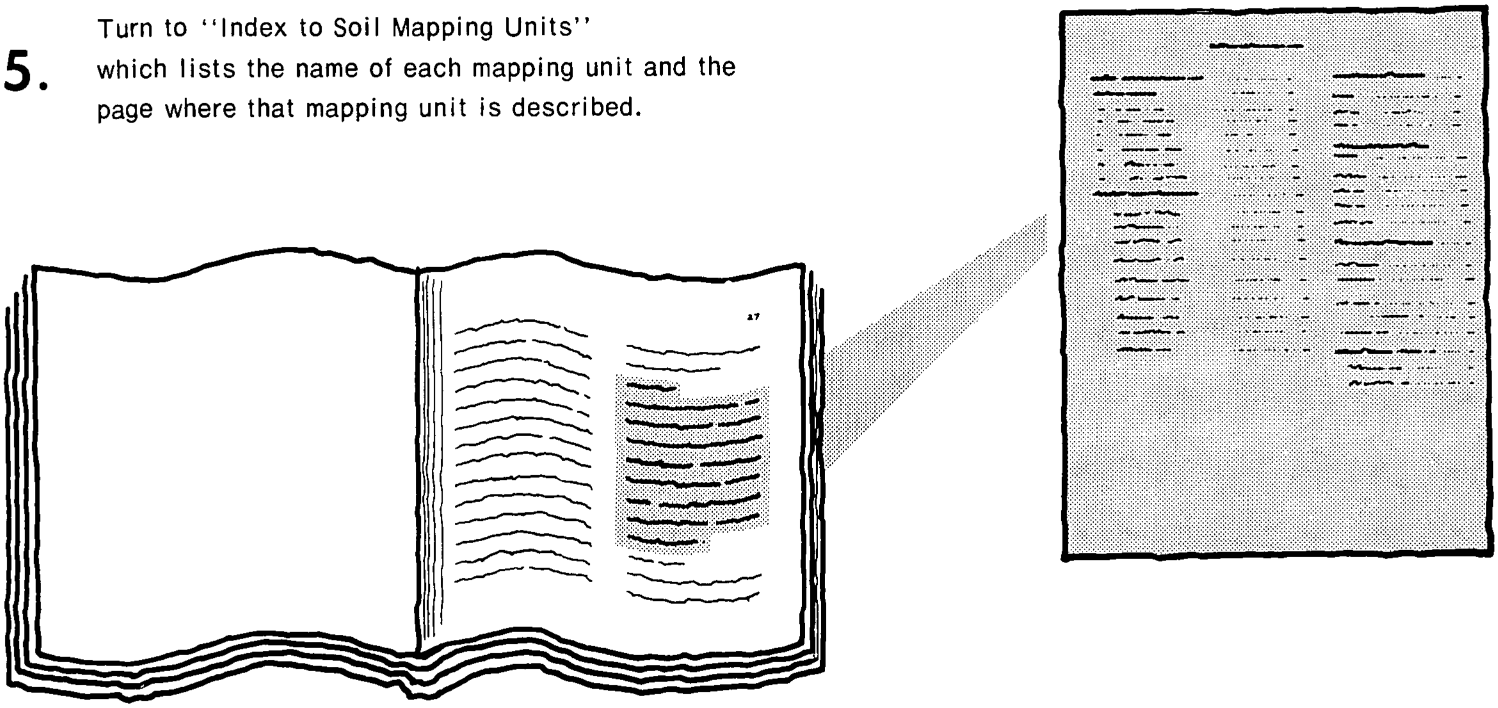


4. List the mapping unit symbols that are in your area.

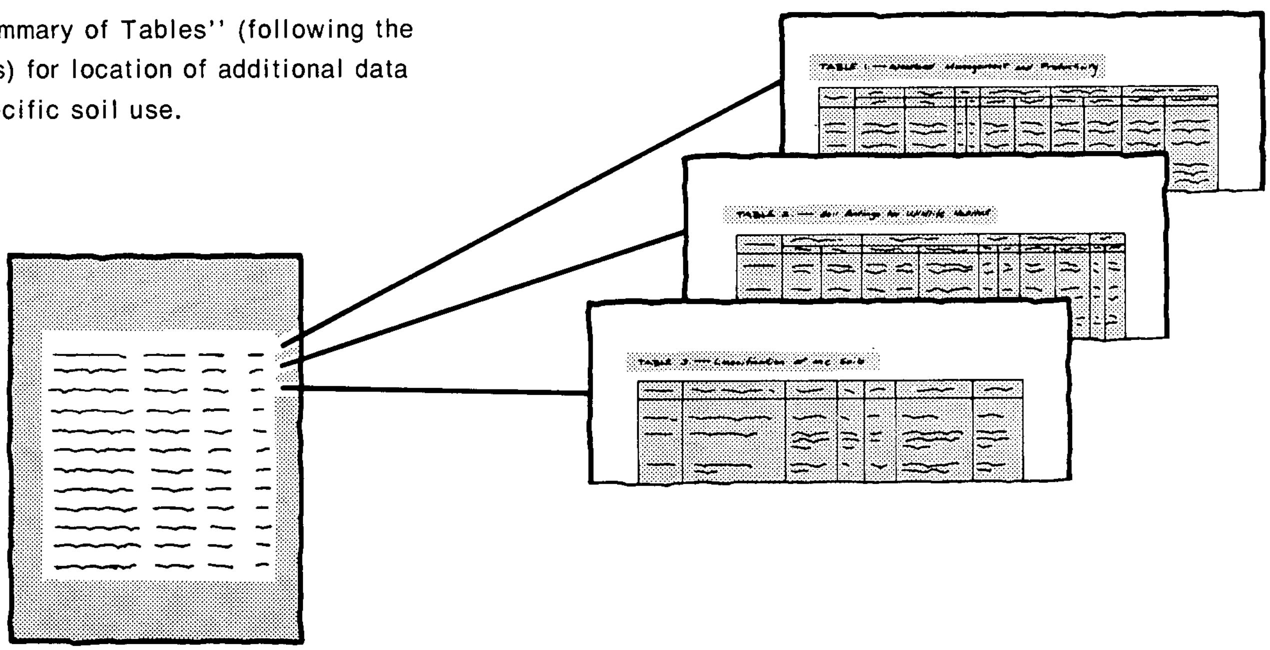


THIS SOIL SURVEY

5. Turn to "Index to Soil Mapping Units" which lists the name of each mapping unit and the page where that mapping 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 is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. 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 completed in the period 1970-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. 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 North Concho River Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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Issued October 1977

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Foreword

The Soil Survey of Sterling County, Texas, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

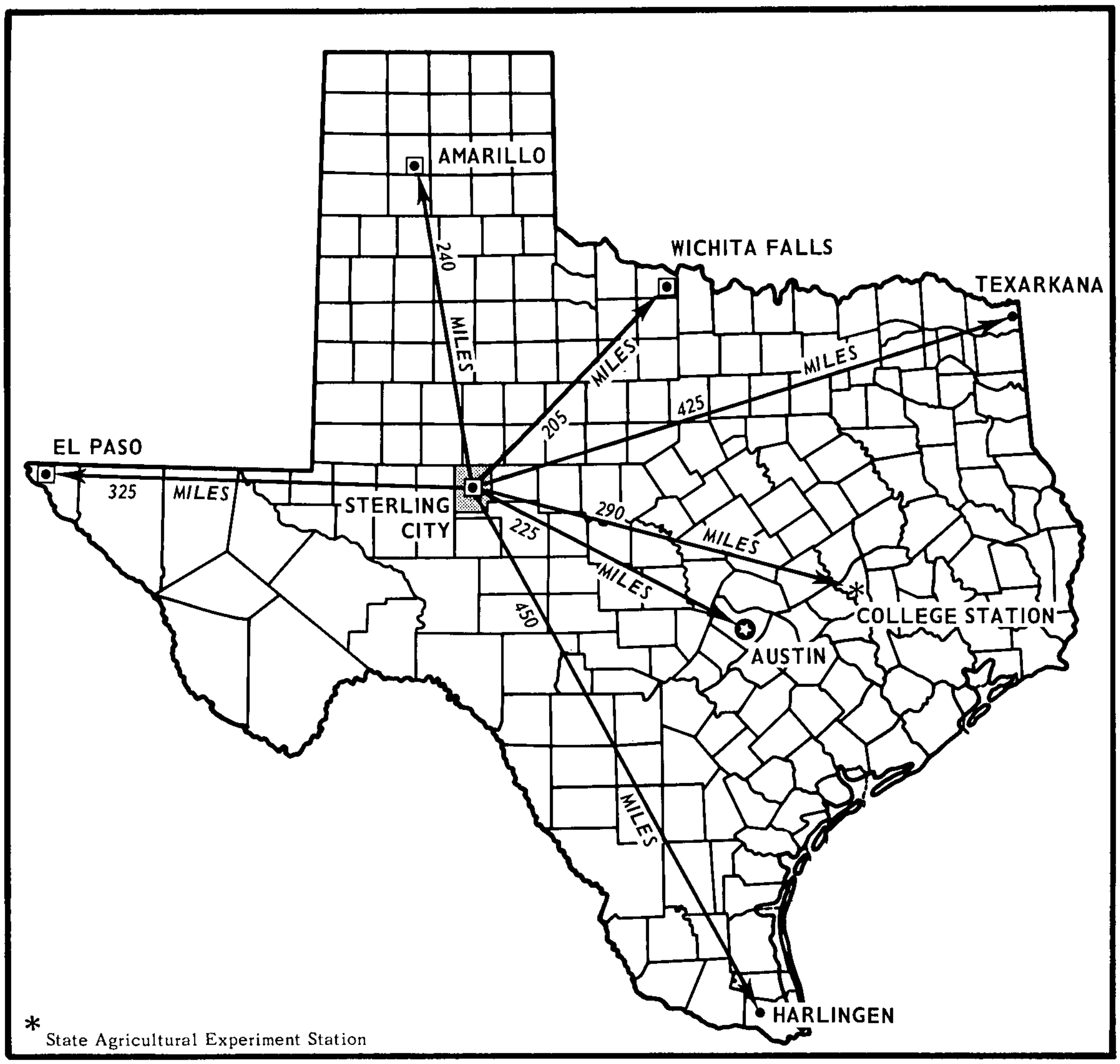
This soil survey has been prepared for many different users. Farmers, ranchers, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields.

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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

We believe that this soil survey can help bring us a better environment and a better life. Its widespread use can greatly assist us in the conservation, development, and productive use of our soil, water, and other resources.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Sterling County in Texas.

SOIL SURVEY OF STERLING COUNTY, TEXAS

By Ervin L. Blum, Soil Conservation Service

Soils surveyed by Ervin L. Blum and Clarence C. Wiedenfeld, Soil Conservation Service

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

STERLING COUNTY is in the west-central part of Texas (see facing page), mainly in the Edwards Plateau Land Resource Area. A small area in the northern part of the county is in the Central Rolling Red Plains Land Resource Area.

The county is rectangular, measuring about 36 miles from north to south and about 26 miles from east to west. It covers 914 square miles, or 584,960 acres. The land surface is nearly level to undulating and hilly. The elevation rises from about 2,300 feet above sea level in the eastern part of the county to about 2,655 feet in the western part. Most of the drainage is eastward through Lacy Creek, Sterling Creek, Mulberry Creek, and the North Concho River. Minor drainageways in the northern part of the county flow northward toward the Colorado River, which is not in Sterling County.

Ranching is the main enterprise in the county. The county is about 97 percent range, 1 percent cropland, and 2 percent urban land, farmsteads, water area, and other miscellaneous lands. Beef cattle, sheep, and goats are the principal ranching stock in the county. Grain sorghum, wheat, oats, and alfalfa are the main cultivated crops.

The soils in this county formed under grass and are dominantly dark colored, loamy, and dry. Unprotected areas are subject to soil blowing and water erosion. The county experiences periods of drought.

General nature of the county

The settlement and population, farming, natural resources, and climate of the county are briefly described in this section.

Settlement and population

Sterling County was organized in 1891. It was created from a part of Tom Green County. It was named for Captain W.S. Sterling, an early settler and rancher.

The population of Sterling County in 1973 was 1,056. Sterling City is the county seat; it has a population of 780.

Farming

The main farming enterprises in Sterling County are beef cattle, sheep, and goat ranches. Ranch income is supplemented by leases for hunting deer and turkey. A minor acreage of the county is used for nonirrigated and irrigated crops.

Livestock operations are primarily cow-calf. Supplemental feeding is generally heavy. Stock are fed from December to late in February or March. Calves are commonly sold on a contract basis; delivery dates are in late spring or early summer.

Grain sorghum, wheat, oats, and alfalfa are grown on some farms and ranches. About 4,800 acres are nonirrigated, and about 2,500 acres are irrigated. Cultivated crops are used mainly as supplemental feed for livestock.

Natural resources

Soil is one of the most important natural resources in the county. The production of livestock forage is a major source of livelihood for the people.

Oil and gas are obtained from numerous wells in the county and also provide a major source of income to some landowners. Many people are employed by companies that drill and service oil and gas wells.

A few irrigation wells supply water for supplemental irrigation of crops.

Climate

Sterling County does not have an official weather station. The nearest official weather station is at the San Angelo Reservoir, on the North Concho River about 38 miles southeast of Sterling City. For all practical purposes the climate of Sterling County is the same as that recorded at the San Angelo Reservoir station.

The climate is subtropical; winters are dry and summers are hot and humid. Mean annual rainfall is 18.38 inches. The rainfall pattern is typical of the Edwards Plateau; more rain falls in May and September than in any other month. Three-fourths of the mean annual rainfall occurs during the warm season, April through October. Much of the warm-season rainfall is a result of thunderstorm activity, and wide variations in amounts occur from year to year. In exceptionally wet years, a significant proportion of the rainfall results from excessive downpours. Drought periods occur rather frequently. Data on temperature and precipitation are given in table 1.

The county has wide ranges in temperatures in summer and winter. This is characteristic of a continental type of climate. Periods of cold weather are short, however, so that even in January, periods of fair, mild weather are frequent. Hot daytime temperatures prevail for a considerable period in summer, but these are broken occasionally by thundershowers. Rapid cooling occurs after nightfall.

Rapid temperature changes occur in winter and early spring. Frequent northers are effective in closing off the supply of moisture from the Gulf of Mexico from about November through March, so this is a relatively dry period. Precipitation can fall in the form of rain, freezing rain, sleet, or snow, although significant amounts of snow are rare. The statistical mean does not adequately represent snowfall data, because it is biased by a few very rare, but exceptionally heavy, snows that occur only about once every 10 years or longer.

In an average year the county receives 63 percent of the total possible sunshine in winter, 68 percent in spring, 78 percent in summer, and 71 percent in fall. Mean relative humidity at noon is 50 percent in January, 43 percent in April, 41 percent in July, and 50 percent in October. Prevailing winds are southerly from April through October; southwesterly in November and January; south-southwesterly in February and March; and westerly during December. Thunderstorms occur on 36 days during an average year.

Estimated mean annual lake (free water) evaporation is 71 inches. Evaporation exceeds precipitation by about 52 inches in an average year.

The mean length of the freeze free period is 235 days. The mean dates of the last freezing temperature in spring and the first in fall are March 25 and November 15, respectively.

Spring and fall are the most pleasant seasons in the area. Temperatures are more moderate then than in winter or summer. Windspeeds are lightest from July through October and strongest during March and April. Evaporative-type home air conditioners are effective for cooling about 96 percent of the time during July and August.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. 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; the kinds of rock; and many facts about the soils. They dug many holes to expose 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 the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil mapping units. Some mapping units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Mapping units are discussed in the section "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and their interpretations are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices 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 is readily useful to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

Soil map for general planning

The general soil map at the back of this publication shows, in color, the soil associations described in this survey. Each soil association is a unique natural landscape unit that has a distinct pattern of soils and of relief and drainage features. An association typically consists of

one or more soils of major extent and some soils of minor extent. It is named for the major soils. The kinds of soil in one association can occur in other soil associations, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are generally suitable for certain kinds of farming or other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soils in any one soil association ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Descriptions and potentials of soil associations

The six soil associations in Sterling County are described in the following paragraphs.

1. Ector association

Very shallow and shallow, undulating to hilly, very gravelly, moderately permeable, loamy soils on uplands

This association is made up of dominantly undulating to hilly soils that have slopes of 1 to 30 percent. It makes up about 38 percent of the county. Ector soils make up about 75 percent of the association, and less extensive areas of Angelo, Berda, Broome, Dev, Mereta, Rioconcho, and Tarrant soils make up the remaining 25 percent.

Ector soils are on limestone plateaus, plains, and erosional landscapes. These soils typically have a surface layer of friable, moderately alkaline, dark grayish brown very gravelly loam about 17 inches thick. Limestone fragments make up about 65 percent, by volume, of the surface layer. This layer has an abrupt boundary and rests on fractured limestone bedrock, which extends to a depth of more than 80 inches.

The deep, loamy, nearly level to gently sloping Angelo soils are on uplands. The deep, loamy Berda and Broome soils are on foot slopes and outwash plains. The deep, loamy Dev and Rioconcho soils are on the bottoms of flood plains of streams and drainageways. The shallow, loamy Mereta soils are on ridges and outwash plains. The very shallow to shallow, clayey Tarrant soils are on convex ridgetops and breaks of erosional landscapes.

This association is used almost entirely as range.

Potential for cultivated crops is low. Slope, shallow or very shallow rooting depth, and the hazard of water erosion restrict use of the association mainly to range. A few small areas of the less extensive soils can be cultivated. In these areas grain sorghum, wheat, and oats are the main cultivated crops.

Potential for range is also low. Low rainfall, very low available water capacity, and restricted rooting depth limit the amount of forage produced during most years. Native range plants are mainly short and mid grasses.

Potential for most urban uses is low. Slope, shallow or very shallow depth to limestone bedrock, and corrosivity to uncoated steel are the most limiting features. Potential for recreational uses is medium. Slope and small stones on the surface restrict use of the association for camp areas, picnic areas, playgrounds, and paths and trails.

2. Angelo-Rioconcho-Broome association

Deep, nearly level and gently sloping, moderately permeable to slowly permeable, loamy soils on uplands and bottom lands

This association is made up of dominantly nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 35 percent of the county. Angelo soils make up about 61 percent of the association; Rioconcho soils, about 12 percent; Broome soils, about 12 percent; and less extensive areas of Colorado, Kimbrough, Olton, Owens, Potter, and Reagan soils, the remaining 15 percent.

The nearly level to gently sloping Angelo soils are in broad areas on uplands. These soils have a surface layer about 14 inches thick. The upper 8 inches is friable, moderately alkaline, grayish brown silty clay loam, and the lower 6 inches is friable, moderately alkaline, brown clay loam. Between depths of 14 and 29 inches is firm, moderately alkaline, brown clay loam. To a depth of 58 inches is friable, moderately alkaline, pink silty clay loam that is about 40 to 50 percent, by volume, soft bodies and weakly cemented concretions of calcium carbonate. The lower 22 inches is friable, moderately alkaline, pink clay loam that is about 30 percent fragments of limestone and conglomerate.

The nearly level Rioconcho soils are on bottom lands. These soils have a surface layer of firm, moderately alkaline, grayish brown silty clay loam about 16 inches thick. The next layer is firm, moderately alkaline, brown silty clay that extends to a depth of about 42 inches. To a depth of 78 inches is firm, moderately alkaline, brown silty clay that contains films, threads, and soft bodies of calcium carbonate. Between depths of 78 and 80 inches is friable, moderately alkaline, pinkish gray clay loam.

Broome soils are on side slopes of valleys and draws. These soils have a surface layer of friable, moderately alkaline, brown silty clay loam about 7 inches thick. The next layer is friable, moderately alkaline, brown silty clay loam that extends to a depth of about 18 inches. Between depths of 18 and 39 inches is friable, moderately alkaline, light brown silty clay loam that is about 30 percent, by volume, soft bodies of calcium carbonate. Between depths of 39 and 80 inches is friable, moderately alkaline, reddish yellow silty clay loam that is about 10 percent, by volume, soft bodies of calcium carbonate.

The deep, loamy, nearly level Colorado soils are on bottom lands. The shallow to very shallow, loamy and clayey Kimbrough, Owens, and Potter soils are on undulating ridgetops and side slopes of low hills. The deep, loamy, nearly level to gently sloping Olton and Reagan soils are on uplands.

This association is used mainly as range, but some areas are cultivated.

Potential for cultivated crops is high, but low rainfall and lack of irrigation water limit the amount of this association used for cultivated crops. When the soil is cultivated, grain sorghum, wheat, oats, and alfalfa are the main crops.

Potential for range is high, but low rainfall limits yields during some years. Native range plants are mainly short and mid grasses on the uplands and tall grasses on the bottom lands.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, restricted percolation, and flooding are the most limiting features. Potential for recreational uses is medium, mainly because of slow percolation, flooding, and clay content of the surface layer.

3. Mereta-Angelo association

Shallow to deep, nearly level and gently sloping, moderately slowly permeable, loamy soils on uplands

This association is made up of dominantly nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 11 percent of the county. Mereta soils make up about 50 percent of the association; Angelo soils, about 30 percent; and less extensive areas of Broome, Lipan, and Tobosa soils, the remaining 20 percent.

The nearly level to gently sloping Mereta soils are on uplands of outwash plains. These soils have a surface layer of friable, moderately alkaline, brown clay loam about 15 inches thick. The surface layer has an abrupt boundary and rests on a layer of pinkish white, strongly cemented caliche that extends to a depth of about 24 inches. Between depths of 24 and 78 inches, the soil is pink, weakly cemented caliche of about clay loam texture.

The nearly level to gently sloping Angelo soils are in broad areas on uplands. These soils have a surface layer about 14 inches thick. The upper 8 inches is friable, moderately alkaline, grayish brown silty clay loam, and the lower 6 inches is friable, moderately alkaline, brown clay loam. Between depths of 14 and 29 inches is firm, moderately alkaline, brown clay loam. To a depth of 58 inches is friable, moderately alkaline, pink silty clay loam that is about 40 to 50 percent, by volume, soft bodies and weakly cemented concretions of calcium carbonate. The lower 22 inches is friable, moderately alkaline, pink clay loam that is about 30 percent fragments of limestone and conglomerate.

The deep, loamy, gently sloping Broome soils are on side slopes of valleys and draws. The deep, clayey, nearly level Lipan soils are on bottoms of depressions or shallow playas. The deep, clayey, nearly level Tobosa soils are in wide valleys and on wide divides.

This association is used mainly as range, but some areas are cultivated.

Potential for cultivated crops is medium. When the soil is cultivated, nonirrigated grain sorghum and wheat are the main crops.

Potential for range is medium during most years. Native range plants are mainly short and mid grasses.

Potential for most urban and recreational uses is medium. Most of the soils are shallow to indurated caliche and are corrosive to uncoated steel. Some of the soils shrink and swell with changes in moisture and have low strength.

4. Kimbrough-Potter association

Very shallow and shallow, undulating, gravelly, moderately permeable, loamy soils on uplands

This association is made up of dominantly undulating soils that have slopes of 1 to 8 percent. It makes up about 9 percent of the county. Kimbrough soils make up about 60 percent of the association; Potter soils, about 15 percent; and less extensive areas of Angelo, Broome, Conger, Ector, Owens, and Sharvana soils, the remaining 25 percent.

The undulating Kimbrough soils are on convex ridgetops and low hills. These soils have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 9 inches thick. This layer is about 25 percent, by volume, fragments of caliche less than 3 inches in size. The surface layer has an abrupt boundary and rests on a layer of white, indurated and strongly cemented caliche that extends to a depth of about 24 inches. Between depths of 24 and 80 inches, the soil is friable, moderately alkaline, pink loam that is about 33 percent, by volume, strongly cemented fragments of caliche.

The undulating Potter soils are on convex to plane side slopes of ridges and low hills leading to the natural drainageways. These soils have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 7 inches thick. The next layer extends to a depth of about 19 inches; it consists of pinkish white, fractured platy fragments of caliche. Between depths of 19 and 80 inches is moderately alkaline, pinkish white caliche of about loam texture.

The deep, loamy, nearly level to gently sloping Angelo soils are on uplands. The deep, loamy Broome soils are on side slopes of valleys and draws. The shallow, loamy Conger soils are on ridges and divides. The shallow or very shallow, loamy Ector soils are on erosional landscapes and side slopes of limestone plateaus and hills. The shallow, clayey Owens soils are on side slopes of ridges and low hills. The shallow, loamy Sharvana soils are on side slopes and foot slope fans of low hills.

This association is used almost entirely as range.

Potential for cultivated crops is low. Slope, very shallow or shallow rooting depth, and the hazard of water erosion restrict use of the association mainly to range. A few small areas of the less extensive soils can be cultivated. In such areas grain sorghum and wheat are the main cultivated crops.

Potential for range is also low. Low rainfall, very low available water capacity, and restricted rooting depth limit the amount of forage produced during most years. Native range plants are mainly short and mid grasses.

Potential for most urban uses is low. Slope, corrosivity to uncoated steel, caliche fragments on the surface, and shallow or very shallow depth to indurated caliche or caliche are the most limiting features. Potential for recreational uses is medium. Slope, fragments on the surface, and soil depth are the most restrictive features.

5. Conger-Reagan association

Shallow to deep, nearly level and gently sloping, moderately permeable, loamy soils on uplands

This association is made up of dominantly nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 5 percent of the county. Conger soils make up about 60 percent of the association; Reagan soils, about 15 percent; and less extensive areas of Angelo, Ector, and Tobosa soils, the remaining 25 percent.

The gently sloping Conger soils are on ridges and divides. These soils have a surface layer of friable, moderately alkaline, brown loam about 5 inches thick. Between depths of 5 and 14 inches is friable, moderately alkaline, brown clay loam. At a depth of 14 inches, the soil has an abrupt boundary and rests on a layer of pinkish white, strongly cemented caliche. This layer is about 10 inches thick. Between depths of 24 and 80 inches is pink to light brown caliche of about clay loam texture.

The nearly level to gently sloping Reagan soils are on limestone plateaus, alluvial fans, and valley fill. These soils typically have a surface layer of friable, moderately alkaline, brown silty clay loam about 9 inches thick. The next layer is friable, moderately alkaline, light brown silty clay loam that extends to a depth of about 34 inches. Between depths of 34 and 52 inches is friable, moderately alkaline, pink silty clay loam that is about 35 percent, by volume, weakly cemented concretions of calcium carbonate. Between depths of 52 and 80 inches is friable, moderately alkaline, reddish yellow silty clay loam that is about 15 percent, by volume, weakly cemented concretions of calcium carbonate.

The deep, loamy, nearly level to gently sloping Angelo soils are on uplands. The shallow or very shallow, loamy Ector soils are on limestone plateaus, plains, and erosional landscapes. The deep, clayey, nearly level Tobosa soils are in wide valleys and on wide divides.

This association is used mainly as range, but some areas can be cultivated.

Potential for cultivated crops is low. Most of the soils are shallow to cemented caliche. When the soils are cultivated, grain sorghum and wheat are the main crops.

Potential for range is low. Most of the soils in this association produce limited yields of short and mid grasses.

Potential for most urban uses is low. Shallow depth to cemented caliche and corrosivity to uncoated steel are the most limiting features. This association has medium potential for most recreational uses.

6. Tobosa-Lipan association

Deep, nearly level, very slowly permeable, clayey soils on uplands

This association is made up of dominantly nearly level soils that have slopes of 0 to 1 percent. It makes up about 2 percent of the county. Tobosa soils make up about 60 percent of the association; Lipan soils, about 7 percent; and less extensive areas of Angelo and Mereta soils, the remaining 33 percent.

The nearly level Tobosa soils are in wide valleys and on wide divides and low mesas. In the center of a microflat, these soils have a surface layer of very firm, moderately alkaline clay about 48 inches thick. It is dark grayish brown in the upper 34 inches and brown in the lower 14 inches. Intersecting slickensides are below a depth of 24 inches. The next layer extends to a depth of about 60 inches; it is very firm, moderately alkaline, brown clay that is about 4 percent soft bodies and concretions of calcium carbonate. Between depths of 60 and 80 inches is firm, moderately alkaline, yellowish red silty clay loam that is about 10 percent, by volume, soft bodies and concretions of calcium carbonate.

The nearly level Lipan soils are on bottoms of depressions or shallow playas. In the center of a microdepression, these soils have a surface layer of very firm, moderately alkaline, gray clay about 16 inches thick. This layer changes gradually to a layer of very firm, moderately alkaline, grayish brown clay that extends to a depth of about 60 inches and that contains slickensides. Between depths of 60 and 80 inches is very firm, moderately alkaline, brown clay that contains a few concretions of calcium carbonate.

The deep, loamy, nearly level to gently sloping Mereta soils are on uplands of outwash plains.

This association is used mainly as range, but some areas are cultivated.

Potential for cultivated crops is high. When the soils are cultivated, grain sorghum and wheat are the main crops.

This association has medium potential for range. The soils are droughty and produce moderate amounts of mid and short grasses during most years.

Potential for most urban and recreational uses is low. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and the clayey surface layer are the main restrictive features.

Broad land use considerations

The soil associations in Sterling County vary widely in their potential for major land uses, as indicated in table 2. For each land use, general ratings of the potential of each soil association in relation to the other soil associations are indicated. Kinds of soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of several land-use practices and the hazard of continued soil-related problems after such practices have been installed. The ratings do not consider location in relation to existing transportation systems or to other kinds of facilities.

Kinds of land uses considered include cultivated farm crops, specialty crops, range, urban uses, and recreation areas. Cultivated farm crops grown in the survey area include cotton, grain sorghum, wheat, oats, and alfalfa. Specialty crops include vegetables, fruits, pecans, and nursery crops, which are grown on a limited acreage and which generally require intensive management. Range refers to land in native range plants. Urban uses include land use for farmsteads and residential, commercial, and industrial sites. Recreation areas include nature study areas, paths and trails, picnic areas, camp areas, playgrounds, and wilderness areas.

In general, the kinds of soil, the low rainfall, and the lack of irrigation water are the most important factors that influence land use in Sterling County.

About 97 percent of the county is used as range, and about 1 pecent is used for cultivated farm crops. According to table 2, however, about 35 percent of the county has high potential as range, about 13 percent has medium potential, and about 52 percent has low potential. Table 2 also indicates that about 37 percent of the county has high potential for cultivated farm crops, about 11 percent has medium potential, and about 52 percent has low potential. This means that about 36 percent of the county could be converted from range to cultivated farmland if water were available.

The trend in recent years has been a slight decrease in the acreage used as range and a slight increase in the acreage used as cropland. This trend has generally corresponded with an increase in the development of irrigation water supplies.

There has also been a slight increase in the number of acres used for specialty crops, urban development, and recreational development.

In general, the Angelo-Rioconcho-Broome association and the Tobosa-Lipan association have high potential for cultivated farm crops. The soils in these associations are deep, loamy or clayey, and are well suited to cultivated crops. They require good management practices, however, to prevent water erosion and soil blowing. The Angelo-Rioconcho-Broome association has high potential as range. The deep, loamy soils in that association require careful management to prevent water erosion. In addition, they require good design and installation procedures when used for urban structures. The main concerns are shrink-swell, corrosivity, and low strength. None of the associations has high potential for recreational development. The shallow or very shallow, loamy soils of the Ector and Kimbrough-Potter associations have low potential for most uses. Slope, the hazard of water erosion, small stones on the surface, and depth to indurated caliche or limestone bedrock are the most limiting features.

The general soils information in this section and the more detailed information in the following sections can be used as a guide in planning orderly growth and development of the county. This information is especially helpful in determining which lands to allocate to each use.

Soil maps for detailed planning

The kinds of soil (mapping units) shown on the detailed soil maps at the back of this publication are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each soil is given in the section "Use and management of the soils."

Preceding the name of each mapping unit is the symbol that identifies the unit on the detailed soil map. Each mapping unit description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated and the management concerns and practices needed are discussed.

A soil mapping unit represents an area on the landscape and consists mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map at the back of this publication are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. All the soils in the United States having the same series name have essentially the same properties that affect their use and their response to management practices.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristic that affects the use of the soils. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Mereta clay loam, 0 to 1 percent slopes, is one of several phases within the Mereta series.

Some mapping units are made up of two or more dominant kinds of soil. Two such kinds of mapping units are shown on the soil map of this survey area: soil associations and undifferentiated groups.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map. A soil association has considerable regularity in geographic pattern and in the kinds of soil that make up the association. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for the expected uses of the soils. Cobb **association, undulating, is an example.**

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Dev and Rioconcho soils is an undifferentiated group in this county.

Most mapping units include small, scattered areas of soils other than those that appear in the name of the mapping unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the mapping unit. The soils that are included in mapping are recognized in the description of each mapping unit.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example.

The acreage and proportionate extent of each mapping unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses are given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

AnA—Angelo silty clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. Slopes average about 0.7 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

The surface layer is about 14 inches thick (fig. 1). The upper 8 inches is friable, moderately alkaline, grayish brown silty clay loam. The lower 6 inches is friable, moderately alkaline, brown clay loam. Between depths of 14 and 29 inches is firm, moderately alkaline, brown clay loam. Below this to a depth of 58 inches is friable, moderately alkaline, pink silty clay loam that is about 40 to 50 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate. Below a depth of 58 inches is friable, moderately alkaline, pink clay loam that is about 30 percent fragments of limestone and conglomerate.

This soil is well drained. Runoff is slow. Permeability is moderately slow. Available water capacity is high. The root zone is deep, but the lower layers tend to impede the movement of air, water, and roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Broome, Olton, and Tobosa soils. Also included are small areas of Angelo soils that have a surface layer of clay loam. Included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Wheat and grain sorghum are the main crops.

Potential for nonirrigated or irrigated cotton, wheat, oats, and grain sorghum is high. Potential for irrigated alfalfa is high. Keeping crop residue on or near the soil surface helps conserve moisture. Residue also helps protect the soil from water erosion and soil blowing. A properly designed irrigation system and proper application of irrigation water are essential. A surface or sprinkler system can be used. Fertilizer is necessary when this soil is irrigated.

Potential for native range plants is medium. Low rainfall, however, produces only moderate yields of short and mid grasses during some years. Potential for wildlife habitat is also medium.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, low strength, and slow percolation rate are the most restrictive features. Potential for recreational uses is medium mainly because of the silty clay loam surface layer and the slow percolation rate. Capability subclass IIIc nonirrigated, capability class I irrigated; Clay Loam range site.

AnB—Angelo silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands along natural drainageways. Slopes average about 2 percent. Areas are irregular to oblong in shape and range from 15 to 400 acres in size.

This soil has a surface layer about 13 inches thick. The upper 6 inches is friable, moderately alkaline, grayish brown silty clay loam. The lower 7 inches is friable, moderately alkaline, brown clay loam. The next layer is friable, moderately alkaline, brown clay loam that extends to a depth of about 41 inches. Between depths of 41 and 80 inches is friable, moderately alkaline, pink clay loam that is about 30 percent, by volume, calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is high. The root zone is deep, but the lower layers tend to impede the movement of air, water, and roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Broome, Olton, and Tobosa soils. Also included are small areas of Angelo soils that have a surface layer of clay loam. Included soils make up less than 20 percent of any one mapped area.

This soil is used almost entirely as range, but it can be cultivated. Wheat and grain sorghum are the main cultivated crops.

Potential for nonirrigated and irrigated cotton, wheat, oats, and grain sorghum is high. Potential for irrigated alfalfa is medium. Crop residue needs to be left on or near the soil surface. Residue helps to control water erosion, to protect the soil from blowing, and to conserve moisture. Contour farming and terraces are needed to control runoff. Grassed waterways provide good outlets for terrace systems. A properly designed irrigation system and proper application of irrigation water are essential. A sprinkler system is best adapted. If a surface system is used, bench leveling is necessary. Fertilizer is needed when this soil is irrigated.

Potential for native range plants is medium. Low rainfall and medium runoff limit this soil to moderate yields of short and mid grasses during some years. Potential for wildlife habitat is medium.

This soil has low potential for most urban uses. Corrosivity to uncoated steel, low strength, shrinking and swelling with changes in moisture, and slow percolation rate are the most restrictive features. Potential for recreational uses is medium. The most restrictive features for recreation are slope, a silty clay loam surface layer, and slow percolation rate. Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

BED—Berda soils, undulating. This mapping unit consists of deep soils on uplands, mainly on foot slopes of caliche-capped scarps, ridges, or plateaus. Slopes range from 1 to 8 percent. Areas are irregular in shape and range from 20 to 100 acres in size.

The soils in this mapping unit are neither uniform nor in a regular pattern. They have variable surface textures of loam, fine sandy loam, and clay loam.

Berda soils typically have a surface layer of friable, moderately alkaline, reddish brown loam about 10 inches thick. The next layer is friable, moderately alkaline, light reddish brown sandy clay loam that extends to a depth of about 24 inches. Between depths of 24 and 58 inches is friable, moderately alkaline, reddish brown clay loam that contains a few caliche pebbles and soft bodies of calcium carbonate (fig. 2). Between depths of 58 and 80 inches is friable, moderately alkaline, pink loam that contains about 10 percent caliche fragments and 20 percent soft bodies of calcium carbonate.

These soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Broome and Conger soils. Included soils make up less than 15 percent of any one mapped area.

These soils are not suitable for cultivation, mainly because of slope and susceptibility to water erosion. They are used mainly as range, and potential for native range plants is medium. These soils support short and mid grasses. Potential for wildlife habitat is medium.

Potential for most urban and recreational uses is medium. Slope and corrosivity to uncoated steel are the most limiting features. However, these limitations are easy to overcome by using good design and installation procedures. Capability subclass VIe nonirrigated; Sandy Loam range site.

BrB—Broome silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly on the sides of valleys and draws. Slopes average about 2 percent. Areas are irregular to elongated in shape and range from 5 to 200 acres in size.

This soil has a surface layer of friable, moderately alkaline, brown silty clay loam about 7 inches thick. The next layer is friable, moderately alkaline, brown silty clay loam that extends to a depth of about 18 inches. Between depths of 18 and 39 inches is friable, moderately alkaline, light brown silty clay loam that is about 30 percent, by volume, soft bodies of calcium carbonate concretions. Between depths of 39 and 80 inches is friable, moderately alkaline, reddish yellow silty clay loam that is about 28 percent, by volume, soft bodies of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate. Available water capacity is medium. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Berda, Conger, and Kimbrough soils. Included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as range, but a few small areas are cultivated. Oats, grain sorghum, and wheat can be grown.

Potential for nonirrigated and irrigated cotton, grain sorghum, oats, or wheat is medium. Potential for irrigated alfalfa is also medium. Keeping crop residue on or near the soil surface helps conserve moisture and prevent water erosion and soil blowing. Contour farming, terraces, and grassed waterways help to control water erosion caused by excess runoff. When cuts or excavations exceed 7 inches, there is a hazard of cutting into soil material that contains concentrations of calcium carbonate. If the soil is irrigated, a well-designed irrigation system and proper application of irrigation water are essential. Both surface and sprinkler irrigation sysems can be used. Fertilizer is needed for adequate yields.

Potential for native range plants is medium. Potential for wildlife habitat is also medium.

This soil has medium potential for most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and low strength are the most restrictive factors. Good design and installation procedures are needed. Potential for recreational uses is medium. The dusty clay loam surface layer is the most restrictive feature. Capability subclass IIIe nonirrigated, IIe irrigated; Loamy range site.

CBD—Cobb association, undulating. This association consists of moderately deep soils on uplands. These soils are on ridgetops and side slopes of low hills. Slopes are convex to plane and range from 1 to 8 percent. Mapped areas are irregular in shape and range from 20 to 80 acres in size.

The composition of this association is more variable than other mapping units in the county. Some of the Cobb soils are thinner than is allowed in the range for the series; some are redder in the lower horizons than allowed. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

The surface layer is typically very friable, neutral, reddish brown fine sandy loam about 6 inches thick. The next layer is friable, neutral sandy clay loam that extends to a depth of about 26 inches. It is reddish brown in the upper 11 inches and red in the lower 9 inches. At a depth of 26 inches the soil has an abrupt boundary and rests on a layer of weakly cemeted to strongly cemented, reddish yellow sandstone. The sandstone layer extends to a depth of more than 40 inches.

The soils in this association are well drained. Runoff is rapid. Permeability is moderate, and available water capacity is low. The root zone is moderately deep. The hazards of water erosion and soil blowing are moderate.

Included with these soils in mapping are small areas of Berda, Mereta, and Ector soils. Also included are soils that are similar to Cobb soils except that the combined thickness of the surface layer and subsoil is less than allowed in the range for the series. Included soils make up less than 10 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops because of slope and susceptibility to water erosion and soil blowing. Areas of this association are used mainly as range, and potential for growing native range plants is medium. Tall and mid grasses supply only moderate amounts of forage, even during favorable years. Potential for wildlife habitat, however, is high.

Potential for most urban uses is medium. Slope and depth to sandstone are the most limiting factors. These limitations are easy to overcome if good design and installation procedures are used. Potential for most recreational uses is high. Slope restricts some playground uses. Capability subclass VIe nonirrigated; Sandy Loam range site.

Cd—Colorado soils, frequently flooded. This mapping unit consists of deep soils on bottom lands. These soils are on flood plains of streams. They are flooded about once in 2 years for periods of less than 24 hours by fast-flowing streams. Slopes range from 0 to 1 percent. Soil areas are long and narrow and range from 10 to 150 acres in size.

The soils in this mapping unit are neither uniform nor in a regular pattern. They have variable surface textures of loam, fine sandy loam, and silt loam.

The surface layer is typically friable, moderately alkaline, reddish brown loam about 9 inches thick. The next layer is friable, moderately alkaline, light reddish brown loam that extends to a depth of about 35 inches. This layer is stratified with thin layers of silt loam and fine sandy loam. Between depths of 35 and 80 inches is friable, moderately alkaline, reddish brown loam stratified with thin layers of sand and small, rounded pebbles.

These soils are well drained. Runoff is slow. Permeability is moderate. Available water capacity is high. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Berda and Owens soils. Included soils make up less than 15 percent of any one mapped area.

These soils are not suitable for cultivated crops because of the hazard of flooding. They are used mainly as range, and potential for native range plants is high. These soils produce good yields of mid and tall grasses during most years. The potential of these soils for wildlife habitat is medium.

The soils in this mapping unit are not suitable for urban uses because of flooding. The potential for most recreational uses is medium. Flooding and the dusty surface layer are the most limiting features. The soils in this mapping unit are not suitable for camp areas. Capability subclass Vw nonirrigated; Loamy Bottomland range site.

CnB—Conger loam, 1 to 3 percent slopes. This shallow, gently sloping soil is on uplands, mainly on ridges and divides. Slopes average about 2 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

This soil has a surface layer of friable, moderately clkaline, brown loam about 5 inches thick. Between depths of 5 and 14 inches is friable, moderately alkaline, pale brown clay loam that has an abrupt lower boundary. This is underlain by a layer of pinkish white, strongly cemented caliche (fig. 3), which extends to a depth of about 24 inches. Between depths of 24 and 80 inches is pink to light brown caliche that has texture similar to clay loam.

This soil is well drained. Runoff is medium. Permeability is moderate in the upper 14 inches and moderately slow below. Available water capacity is very low. The root zone is shallow. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Broome, Ector, Kimbrough, and Mereta soils. Included soils make up less than 15 percent of any one mapped area.

This soil is not suitable for cultivated crops. Slope, shallow depth to cemented caliche, and susceptibility to water erosion and soil blowing restrict use of the soil to range. In a few areas, the layers of caliche underlying this soil are mined and used as sources of fill material in road construction.

Potential for native range plants is low. Low rainfall, very low available water capacity, and shallow rooting depth limit the amount of forage grown. Potential for wildlife habitat is medium in areas close to grain and seed crops.

This soil has low potential for most urban uses. Shallow depth to cemented caliche is the most limiting feature. Potential for recreational uses is medium mainly because the soil is dusty. Capability subclass VIe nonirrigated; Shallow range site.

DR—Dev and Rioconcho soils. This mapping unit consists of deep, nearly level to gently sloping soils on bottom lands. These soils are on flood plains of streams. They are flooded about once in 2 to 4 years. Slopes range from 0 to 2 percent. Mapped areas are long and narrow in shape and range from 25 to 200 acres in size.

This mapping unit is about 70 percent Dev soils, 23 percent Rioconcho soils, and 7 percent other soils. These soils are neither uniform nor in a regular pattern.

Dev soils are in slightly lower positions on the flood plain than Rioconcho soils. They typically have a surface layer of friable, moderately alkaline, grayish brown very gravelly loam about 24 inches thick. The surface layer is about 70 percent, by volume, subrounded limestone fragments. Between depths of 24 and 80 inches is friable, moderately alkaline, brown very gravelly loam that is about 80 percent, by volume, subrounded limestone fragments.

Dev soils are well drained. Runoff is slow. Permeability is moderately rapid. Available water capacity is low. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Rioconcho soils typically have a surface layer of firm, moderately alkaline, grayish brown silty clay loam about 16 inches thick. The next layer is firm, moderately alkaline, brown silty clay that extends to a depth of about 42 inches. To a depth of 78 inches is firm, moderately alkaline, brown silty clay that contains films, threads, and soft bodies of calcium carbonate. Between depths of 78 and 80 inches is friable, moderately alkaline, pinkish gray clay loam.

Rioconcho soils are moderately well drained. Runoff is slow. Permeability is slow, and available water capacity is high. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Included with these soils in mapping are small areas of Colorado and Ector soils. Also included are banks of stream channels and soils that are similar to Dev soils except that they are less than 35 percent gravel. Included soils make up less than 15 percent of any one mapped area.

The soils in this mapping unit are not suitable for cultivation mainly because of flooding and gravel on the surface. These soils are used mainly as range, and potential for native range plants is high. Potential for wildlife habitat is medium.

These soils are not suitable for urban uses because of flooding. The potential for most recreational uses is low. Flooding and gravel on the surface are the most limiting features. Capability subclass VIw nonirrigated; Loamy Bottomland range site.

ECD—Ector association, undulating. This association consists of shallow or very shallow soils on uplands. These soils are on limestone plateaus, plains, and erosional landscapes. Slopes range from 1 to 8 percent, but average about 5 percent. About 35 percent of the surface area is covered with limestone fragments. Areas are irregular in shape and range from 25 acres to several hundred acres in size.

This association is about 55 percent Ector very gravelly loam, 33 percent Ector very gravelly clay loam, 7 percent Rock outcrop, and 5 percent other soils. The composition of this association is more variable than that of other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

Ector soils typically have a surface layer of friable, moderately alkaline, dark grayish brown very gravelly loam about 12 inches thick (fig. 4). Limestone fragments make up about 60 percent, by volume, of the surface layer. This layer has an abrupt boundary and is underlain by fractured limestone bedrock that extends to a depth of more than 80 inches.

The soils in this association are well drained. Runoff is rapid. Permeability is moderate, and available water capacity is very low. The root zone is shallow or very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Conger, Kimbrough, and Reagan soils. Included soils make up less than 10 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops because of slope, shallow or very shallow rooting depth, and susceptibility to water erosion. These soils are used mainly as range, but potential for native range plants is low. Low rainfall, rapid runoff, very low available water capacity, and restricted rooting depth limit the amount of forage produced. Potential for wildlife habitat is medium in areas of range.

The soils in this association have low potential for most urban uses and medium potential for most recreational uses. Slope, small stones on the surface, shallow or very shallow depth to bedrock, and corrosivity to uncoated steel are the most limiting features. Capability subclass VIIs nonirrigated; Limestone Hill range site.

ECG—Ector association, hilly. This association consists of shallow or very shallow soils on uplands. These soils are on erosional landscapes and side slopes of limestone plateaus and hills. Slopes range mainly from 10 to 30 percent. An average of about 40 percent of the surface is covered with limestone fragments. Mapped areas are irregular in shape and range from 25 to 700 acres in size.

This association is about 53 percent Ector very gravelly loam, 33 percent Ector very gravelly clay loam, 10 percent Rock outcrop, and 4 percent other soils. The composition of this association is more variable than other mapping units in the county, but mapping has been controlled well enough for the anticipated use of the areas involved.

Ector soils typically have a surface layer of friable, moderately alkaline, dark grayish brown very gravelly loam about 17 inches thick. Limestone fragments make up about 65 percent, by volume, of the surface layer. This layer has an abrupt boundary and rests on fractured limestone bedrock that extends to a depth of more than 80 inches.

These soils are well drained. Runoff is rapid. Permeability is moderate. Available water capacity is very low. The root zone is shallow or very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Conger, Kimbrough, and Mereta soils. Included soils make up less than 10 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops because of slope, shallow or very shallow rooting depth, and susceptibility to water erosion. These soils are used mainly as range, but potential for native range plants is low. Low rainfall, rapid runoff, very low available water capacity, and restricted rooting depth limit the amount of forage produced. Potential for wildlife habitat is medium.

The soils in this association have low potential for most urban and recreational uses. Slope, small stones on the surface, shallow or very shallow depth to bedrock, and corrosivity to uncoated steel are the most limiting features. Capability subclass VIIs nonirrigated; Limestone Hill range site.

KOD—Kimbrough-Owens association, undulating. This association consists of shallow to very shallow soils on uplands. These soils are on narrow ridge divides and side slopes of ridges and low hills. Slopes are convex to plane and range mainly from 1 to 8 percent. Mapped areas are irregular in shape and range from 25 to more than 500 acres in size.

This association is about 48 percent Kimbrough soils, 46 percent Owens soils, and 6 percent other soils. These soils could be separated, but since use and management are similar, separate mapping is not justified.

Kimbrough soils are on narrow ridges and low hilltops. These soils typically have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 9 inches thick. This is about 25 percent, by volume, caliche fragments less than 3 inches across. The surface layer has an abrupt boundary and rests on a layer of white, indurated and strongly cemented caliche that extends to a depth of about 24 inches. Between depths of 24 and 80 inches is friable, moderately alkaline, pink loam that is about 33 percent, by volume, strongly cemented caliche fragments.

Kimbrough soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow to very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Owens soils are on side slopes of ridges and low hills. They typically have a surface layer of very firm, moderately alkaline, reddish brown clay about 5 inches thick. The next layer is very firm, moderately alkaline, reddish brown clay that extends to a depth of about 15 inches and that has threads, films, and soft bodies of calcium carbonate. Between depths of 15 and 80 inches is extremely firm, moderately alkaline, light reddish brown shaly clay.

Owens soils are well drained. Runoff is rapid. Permeability very slow. Available water capacity is low. The root zone is shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with these soils in mapping are small areas of Berda and Conger soils. These included soils make up less than 15 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops mainly because of slope, shallow to very shallow rooting depth, and susceptibility to water erosion. They are used mainly as range, but potential for native range plants is low. Low rainfall, low to very low available water capacity, and the shallow to very shallow rooting zone limits the production of forage. Potential for wildlife habitat is low.

Potential for urban and recreational uses is low. The Kimbrough soils are limited because of slope, corrosivity to uncoated steel, caliche fragments on the surface, and shallow to very shallow depth to indurated caliche. Owens soils are limited because of slope, shrinking and swelling with changes in moisture, corrosivity to uncoated steel, the clayey surface layer, and shallow depth to shaly clay. Capability subclass VIIs nonirrigated; Kimbrough soils in Very Shallow range site, Owens soils in Shallow Clay range site.

KSD—Kimbrough-Sharvana association, undulating. This association consists of shallow to very shallow soils on uplands. These soils are on ridges, low hills, and foot slope fans. Slopes are convex to plane and range mainly from 1 to 8 percent. Mapped areas are oblong to irregular in shape and range from 20 to 50 acres in size.

This association is about 42 percent Kimbrough soils, 30 percent Sharvana soils, and 28 percent other soils. These soils could be separated, but since use and management are similar, separate mapping is not justified.

Kimbrough soils are on ridges and low hilltops. These soils typically have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 9 inches thick. This layer is about 25 percent, by volume, caliche fragments less than 3 inches across. The surface layer has an abrupt boundary and rests on a layer of white, indurated and strongly cemented caliche that extends to a depth of about 24 inches. Between depths of 24 and 80 inches is friable, moderately alkaline, pink loam that is about 33 percent, by volume, strongly cemented caliche fragments.

Kimbrough soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow to very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Sharvana soils are on side slopes and foot slope fans of low hills. They typically have a surface layer of friable, neutral, reddish brown fine sandy loam about 5 inches thick. The next layer is friable, mildly alkaline, reddish brown sandy clay loam that extends to a depth of about 18 inches. Between depths of 18 and 30 inches is a layer of pinkish white, indurated caliche.

Sharvana soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow. The hazards of water erosion and soil blowing are moderate.

Included with these soils in mapping are small areas of Berda, Conger, and Ector soils. Also included are soils that are similar to Sharvana soils except that they are underlain with sandstone at a shallow or very shallow depth. Included soils make up less than 15 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops mainly because of slope, shallow to very shallow rooting depth, and susceptibility to water erosion. They are used mainly as range. Kimbrough soils have low potential for native range plants, and Sharvana soils have medium potential. Low rainfall, very low available water capacity, and shallow or very shallow depth to indurated caliche limit forage production during most years. Kimbrough soils have low potential for wildlfe habitat, and Sharvana soils have medium potential.

Potential for urban uses is low. The most limiting features are slope, corrosivity to uncoated steel, caliche fragments on the surface, and shallow or very shallow depth to indurated caliche. Potential for recreational uses is medium. Slope and soil depth are the most restrictive features. Capability subclass VIIs nonirrigated; Kimbrough soils in Very Shallow range site, Sharvana soils in Sandy Loam range site.

KTD—Kimbrough and Potter soils, undulating. This mapping unit consists of shallow to very shallow soils on uplands. These soils are on ridgetops, low hills, and side slopes leading to the natural drainageways. Slopes are convex to plane and range mainly from 1 to 8 percent. Mapped areas are irregular in shape and range from 25 to 400 acres in size.

This mapping unit is about 69 percent Kimbrough soils, 17 percent Potter soils, and 14 percent other soils. These soils are neither uniform nor in a regular pattern.

Kimbrough soils are on ridgetops and low hills. These soils typically have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 9 inches thick. This layer is about 25 percent, by volume, caliche fragments less than 3 inches across. The surface layer has an abrupt boundary and rests on a layer of white, indurated and strongly cemented caliche that extends to a depth of about 24 inches (fig. 5). Between depths of 24 and 80 inches is friable, moderately alkaline, pink loam that is about 33 percent, by volume, strongly cemented caliche fragments.

Kimbrough soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow to very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Potter soils are on side slopes of ridges and low hills leading to the natural drainageways. They typically have a surface layer of friable, moderately alkaline, grayish brown gravelly loam about 7 inches thick (fig. 6). The next layer is pinkish white, fractured, platy fragments of caliche that extend to a depth of about 19 inches. Between depths of 19 and 80 inches is moderately alkaline, pinkish white caliche of about loam texture.

Potter soils are well drained. Runoff is medium. Permeaility is moderate, and available water capacity is very low. The root zone is very shallow. The hazard of water erosion is moderate, and hazard of the soil blowing is slight.

Included with this soil in mapping are small areas of Angelo, Broome, Conger, and Ector soils. Included soils make up less than 20 percent of any one mapped area.

The soils in this mapping unit are not suitable for cultivated crops. Slope, shallow to very shallow rooting depth, and susceptibility to water erosion restrict the use of these soils to range. Potential for native range plants is low. Yields of forage are limited because of low rainfall, very low available water capacity, medium runoff, and the restricted rooting zone. Potential for wildlife habitat is low.

Potential for most urban uses is low. The limiting features are mainly slope, corrosivity to uncoated steel, caliche fragments on the surface, and shallow or very shallow depth to indurated caliche or caliche. Potential for recreational uses is medium. Slope, fragments on the surface, and soil depth are the most restrictive features. Capability subclass VIIs nonirrigated; Very Shallow range site.

Lc—Lipan clay, depressional. This deep, nearly level soil is on the bottoms of depressions or shallow playas. Slopes range from 0 to 1 percent, but average less than 0.5 percent. The surrounding plains range from 2 to 15 feet higher in elevation than the playa bottoms. Soil areas are circular to oval in shape and range from 5 to 40 acres in size. In undisturbed areas, the surface is characterized by gilgai microrelief, which consists of microknolls and microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

In the center of a microdepression, the surface layer is very firm, moderately alkaline, gray clay about 16 inches thick. This layer changes gradually to a layer of very firm, moderately alkaline, grayish brown clay that extends to a depth of about 60 inches and that contains a few slickensides. Between depths of 60 and 80 inches is very firm, moderately alkaline, brown clay that contains a few concretions of calcium carbonate.

This soil is somewhat poorly drained. Runoff from surrounding soils covers this soil to a depth of a few inches to several feet for periods of a few days to several weeks after rains. When dry, this soil has wide, deep cracks that extend to the surface. Water enters the soil rapidly when the soil is cracked. When the soil is wet, water enters very slowly, and cracks are sealed. Permeability is very slow.

Available water capacity is high. The root zone is deep, but clay content tends to impede the movement of air, water, and roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of a clayey soil that has a slightly darker surface layer than is typical of Lipan soils. These included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Nonirrigated cotton, grain sorghum, and wheat are the main crops. This soil is not suitable for irrigated crops.

Potential for nonirrigated cotton is high, and potential for nonirrigated grain sorghum and wheat is medium. Keeping crop residue on or near the soil surface helps to prevent soil blowing and conserve moisture. It also helps to improve soil tilth and water intake. In dry years, emergency tillage is needed to help control soil blowing where crop residue does not furnish adequate protection. Farming is risky on this soil because of the danger of crops drowning.

This soil has medium potential for native range plants. It is droughty between periods of excessive wetness and produces moderate amounts of forage. Potential for wildlife habitat is low.

Potential for most urban uses is low. Flooding, shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is low mainly because of flooding and the clay surface layer. Capability subclass IVw nonirrigated; Lakebed range site.

MeA—Mereta clay loam, 0 to 1 percent slopes. This shallow, nearly level soil is on uplands, mainly on outwash plains and ancient stream terraces. Slopes average about 0.5 percent. Areas are irregular in shape and range from 5 to 200 acres in size.

This soil has a surface layer of friable, moderately alkaline brown clay loam about 15 inches thick. The surface layer rests abruptly on a layer of pinkish white, strongly cemented caliche that extends to a depth of about 24 inches. Between depths of 24 and 78 inches the soil is pink, weakly cemented caliche of about clay loam texture.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Angelo and Kimbrough soils. Included soils make up less than 15 percent of any one mapped area.

This soil is suitable for nonirrigated crops, but is used mainly as range. It is not suitable for irrigated crops.

Potential for nonirrigated cotton, grain sorghum, and wheat is medium. If this soil is cultivated, careful management is needed to prevent erosion. Crop residue left on or near the soil surface helps protect the soil from water erosion and soil blowing and helps conserve moisture.

This soil has low potential for native range plants. Low rainfall, very low available water capacity, and shallow rooting depth limit the amount of forage produced. Potential for wildlife habitat is medium.

Potential for most urban uses is medium. Shallow depth to indurated caliche, restricted percolation, and high corrosivity to uncoated steel are the most limiting features. These limitations can be overcome by good design and careful installation procedures. The potential for most recreational uses is medium. The clay loam surface layer is the most limiting feature. Capability subclass IIIs nonirrigated; Shallow range site.

MeB—Mereta clay loam, 1 to 3 percent slopes. This shallow, gently sloping soil is on uplands, mainly on outwash plains. Slopes average about 1.5 percent. Areas are irregular in shape and range from 10 to more than 300 acres in size.

This soil has a surface layer of friable, moderately alkaline brown clay loam about 14 inches thick. It has an abrupt boundary and is underlain by a layer of whitish indurated caliche (fig. 7) that extends to a depth of about 24 inches. Between depths of 24 and 78 inches is pink, weakly cemented caliche of about clay loam texture.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Angelo, Conger, Ector, and Kimbrough soils. Included soils make up less than 15 percent of any one mapped area.

This soil is suitable for nonirrigated crops, but is used mainly as range. It is not suitable for irrigated crops.

Potential for nonirrigated cotton, grain sorghum, and wheat is medium. If this soil is cultivated, careful management is needed to conserve moisture and control soil blowing and water erosion. Crop residue left on or near the soil surface helps protect the soil during critical erosion periods. Contour farming, terraces, and grassed waterways help control outside or excess runoff. When cuts or excavations exceed a depth of 14 inches, there is a hazard of cutting into a layer of indurated caliche.

This soil has low potential for native range plants. Low rainfall, very low available water capacity, and shallow rooting depth limit the amount of forage produced. Potential for wildlife habitat is medium.

Potential for most urban uses is medium. Shallow depth to indurated caliche, restricted percolation, and high corrosivity to uncoated steel are the most limiting features. These limitations can be overcome by good design and careful installation procedures. The potential for most recreational uses is medium. The clay loam surface layer is the most limiting feature. Capability subclass IIIe nonirrigated; Shallow range site.

OtB—Olton clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly on outwash plains and ancient stream terraces. Slopes average about 2 percent. Soil areas are irregular in shape and range from 20 to more than 200 acres in size.

This soil has a surface layer of friable, neutral, brown clay loam about 7 inches thick. The next layer is firm, neutral, brown clay loam that extends to a depth of about 16 inches. Between depths of 16 and 32 inches is firm, moderately alkaline, reddish brown clay loam. Between depths of 32 and 80 inches is firm, moderately alkalne, pink to reddish yellow clay loam that is 20 to 30 percent, by volume, soft bodies and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderately slow. Available water capacity is high. The root zone is deep. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Angelo and Broome soils. Included soils make up less than 15 percent of any one mapped area.

This soil is used mostly as range, but it can be cultivated. Potential for nonirrigated cotton, grain sorghum, oats, and wheat is medium. Potential for irrigated grain sorghum, oats, wheat, and alfalfa is high. If the soil is cultivated, careful management is needed to conserve moisture and prevent water erosion. Crop residue left on or near the soil surface conserves moisture and helps protect the soil during critical erosion periods. Contour farming and terraces are needed on this soil. Grassed waterways make good outlets for terrace systems when excess water is a concern. A properly designed irrigation system and proper application of irrigation water are necessary. A sprinkler irrigation system is best adapted. Some bench leveling is needed if a surface irrigation system is used. Fertilizer is needed when this soil is irrigated.

This soil has high potential for native range plants. Yields of mid and short grasses are good, especially during years of adequate rainfall. Potential for wildlife habitat is medium.

Potential for most urban and recreation uses is medium. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and restricted percolation are the main limiting features. Most of the limitations can be overcome by good design and installation procedures. Capability subclass IIIe nonirrigated, IIIe irrigated; Clay Loam range site.

ReA—Reagan silty clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands, mainly on limestone plateaus, on alluvial fans, and in valley fill. Slopes average about 0.6 percent. Areas are irregular in shape and range from 20 to more than 400 acres in size.

The surface layer is friable, moderately alkaline, brown silty clay loam about 10 inches thick. The next layer is friable, moderately alkaline, light brown silty clay loam that extends to a depth of about 35 inches. Between depths of 35 and 60 inches is friable, moderately alkaline, pink silty clay loam that is about 40 percent, by volume, soft bodies and weakly cemented concretions of calcium carbonate. Between depths of 60 and 80 inches is friable, moderately alkaline, pink silty clay loam that is about 20 percent, by volume, calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep, and the soil is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Angelo, Conger, and Lipan soils. Also included are small areas of Reagan soils that have slopes of 1 to 3 percent. Included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Wheat and grain sorghum are the main crops. Most of the areas in cultivation are irrigated. Nonirrigated cotton and oats do not grow well on this soil.

Potential for irrigated cotton and grain sorghum is high. Potential for irrigated oats, wheat, or alfalfa is medium. Keeping crop residue on or near the soil surface helps protect the soil from water erosion and soil blôwing and helps conserve moisture. In dry years, emergency tillage is needed to control soil blowing where crop residue does not provide adequate protection. A properly designed irrigation system and proper application of irrigation water are necessary. A surface or sprinkler system can be used. Fertilizer is needed when this soil is irrigated.

This soil has medium potential for native range plants (fig. 8). Low rainfall limits this soil to moderate yields of mid and short grasses. Potential for wildlife habitat is also medium.

Potential for most urban uses is medium. This soil shrinks and swells with changes in moisture. It is corrosive to uncoated steel, has low strength, and seeps when used for sewage lagoons. Potential for recreational uses is medium. The silty clay loam surface layer is too clayey and is dusty. Capability subclass IVc nonirrigated, capability class I irrigated; Loamy range site.

ReB—Reagan silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly on limestone plateaus and alluvial fans. Slopes average about 2 percent. Areas are irregular to elongated in shape and range from 20 to 200 acres in size.

This soil has a surface layer of friable, moderately alkaline, brown silty clay loam about 9 inches thick. The next layer is friable, moderately alkaline, light brown silty clay loam that extends to a depth of about 34 inches. Between depths of 34 and 52 inches is friable, moderately alkaline, pink silty clay loam that is about 35 percent, by volume, weakly cemented concretions of calcium carbonate. Between depths of 52 and 80 inches is friable, moderately alkaline, reddish yellow silty clay loam that is about 20 percent, by volume, weakly cemented concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep, and the soil is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Angelo, Conger, and Lipan soils. Also included are small areas of Reagan soils that have slopes of 0 to 1 percent. Included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Wheat and grain sorghum are the main crops. Nonirrigated cotton and oats do not grow well on this soil.

Potential for irrigated cotton is high. Potential for nonirrigated or irrigated grain sorghum or wheat is medium. Potential for irrigated oats or alfalfa is medium. Crop residue needs to be left on or near the soil surface to help protect the soil from water erosion and soil blowing. Residue also helps to conserve moisture. In dry years, emergency tillage is needed to control soil blowing where crop residue does not provide adequate protection. Contour farming and terraces are needed on this soil. Grassed waterways make good outlets for terrace systems when excess water is a problem. When cuts or excavations exceed 20 inches, there is a hazard of cutting into soil material that contains concentrations of calcium carbonate. A properly designed irrigation system and proper application of irrigation water are necessary. A sprinkler irrigation system is best adapted. Some bench leveling is needed if a surface irrigation system is used. Fertilizer is needed if this soil is irrigated.

Potential for native range plants is medium. Low rainfall limits this soil to moderate yields of mid and short grasses. Potential for wildlife habitat is medium.

Potential for most urban uses is medium. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and seepage when the soil is used for sewage lagoons are the main limiting features. Potential for recreational uses is medium. The silty clay loam surface layer is too clayey and dusty. Slope restricts some playground uses. Capability subclass IVe nonirrigated, IIe irrigated; Loamy range site.

Ro—Rioconcho silty clay loam. This deep, nearly level soil is on flood plains of streams. It is occasionally flooded by runoff from adjacent slopes. Slopes range from 0 to 1 percent but average about 0.5 percent. Areas are long and narrow. They range from 15 to several hundred acres in size.

This soil has a surface layer of firm, moderately alkaline, grayish brown silty clay loam about 16 inches thick (fig. 9). The next layer is firm, moderately alkaline, brown silty clay that extends to a depth of about 42 inches. To a depth of 78 inches is firm, moderately alkaline, brown silty clay that contains films, threads, and soft bodies of calcium carbonate. Between depths of 78 and 80 inches is friable, moderately alkaline, pinkish gray clay loam.

This soil is moderately well drained. Runoff and permeability are slow. Available water capacity is high. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Angelo, Broome and Dev soils. Included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as range, but a few areas are cultivated. Oats and grain sorghum are the main cultivated crops.

Potential for growing nonirrigated and irrigated cotton or grain sorghum is high. Keeping crop residue on or near the soil surface helps control water erosion, prevent soil blowing, and conserve moisture. Diversion terraces help protect this soil from runoff from adjacent slopes. If this soil is irrigated, a well-designed irrigation system and proper application of irrigation water are necessary. A surface or sprinkler system can be used. Fertilizer is needed if this soil is irrigated.

This soil has high potential for native range plants. Low rainfall is the most limiting factor. Potential for wildlife habitat is medium.

Potential for urban uses is low. Occasional flooding, slow percolation, shrinking and swelling with changes in moisture, and low strength are the most restrictive features. Potential for recreational uses is medium mainly because of the silty clay loam surface layer. Capability subclass IIc nonirrigated, capability class I irrigated; Loamy Bottomland range site.

TAG—Tarrant-Rock outcrop association, hilly. This association consists of shallow or very shallow soils on uplands. These soils are on convex ridgetops and breaks of erosional landscapes. Some areas are on side slopes of limestone plateaus and hills. Slopes range mainly from 10 to 30 percent. Mapped areas are irregular in shape and range from 25 to 600 acres in size.

This association is about 62 percent Tarrant cobbly clay, 14 percent Rock outcrop, 12 percent Ector very gravelly clay loam, and 12 percent other soils. The composition of this association is more variable than that of other mapping units in the county, but mapping has been controlled well enough for the anticipated use of the areas involved.

Tarrant soils typically have a surface layer of very firm, moderately alkaline, very dark grayish brown cobbly clay about 6 inches thick (fig. 10). Limestone fragments make up about 70 percent, by volume, of the surface layer. Between depths of 6 and 12 inches is a layer that is about 90 percent limestone fragments and 10 percent very firm, moderately alkaline, dark grayish brown clay in the interstitial spaces. This layer has an abrupt boundary and rests on white, fractured limestone bedrock that extends to a depth of more than 20 inches.

The Rock outcrop in this association consists of exposures of limestone bedrock on ridgetops and along benches on the side of ridges.

The soils in this association are well drained. Runoff is rapid. Permeability is moderately slow. Available water capacity is very low. The root zone is shallow or very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Kimbrough, Owens, and Potter soils. Included soils make up less than 15 percent of any one mapped area.

The soils in this association are not suitable for cultivated crops mainly because of slope, shallow or very shallow rooting depth, and susceptibility to water erosion. Areas of this association are used as range, but potential for native range plants is low. Low rainfall, rapid runoff, very low available water capacity, and restricted rooting depth limit the amount of forage produced. Potential for wildlife habitat in areas of range is medium.

Potential for urban and recreational uses is low. Slope, large stones on the surface, Rock outcrop, shallow or very shallow depth to bedrock, and corrosivity to uncoated steel are the most limiting features. Capability subclass VIIs nonirrigated; Low Stony Hill range site.

ToA—Tobosa clay, 0 to 1 percent slopes. This deep, nearly level soil is on uplands, mainly in wide valleys and on wide divides and low mesas. Areas are irregular in shape and range from 10 to 300 acres in size. Slopes are slightly concave. In undisturbed areas, the surface is characterized by weakly expressed gilgai microrelief, which consists of microflats and microdepressions. Evidence of gilgai microrelief is destroyed during normal cultivation procedures.

In the center of a microflat, the surface layer is very firm, moderately alkaline clay about 48 inches thick. It is dark grayish brown in the upper 34 inches and brown in the lower 14 inches. Intersecting slickensides are below a depth of 24 inches. The next layer is very firm, moderately alkaline, brown clay that extends to a depth of about 60 inches and that is about 4 percent soft bodies and concretions of calcium carbonate. Between depths of 60 and 80 inches is firm, moderately alkaline, yellowish red silty clay loam that is about 10 percent, by volume, soft bodies and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. When it is dry, this soil has deep, wide cracks that extend to the surface. Water enters the soil rapidly when the soil is cracked; however, water enters very slowly when the soil is wet and seals the cracks. Permeability is very slow. Available water capacity is high. The root zone is deep, but clay content tends to impede the movement of air, water, and roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Angelo and Lipan soils. Included soils make up less than 15 percent of most mapped areas.

This soil is used mainly as range, but a few areas are cultivated. Nonirrigated grain sorghum and wheat are the main crops. Irrigation is not suitable on this soil.

Potential for nonirrigated cotton, grain sorghum, and wheat is high. Crop residue left on or near the soil surface helps control water erosion, prevent soil blowing, and conserve moisture. It also helps to improve soil tilth and water intake. In dry years, emergency tillage helps to control soil blowing where crop residue does not furnish adequate protection.

This soil has medium potential for native range plants (fig. 11). It is droughty and produces moderate amounts of forage. Potential for wildlife habitat is low.

Potential for most urban uses is low. Shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Potential for recreational uses is low mainly because of the clay surface layer. Capability subclass IIIs nonirrigated; Clay Flat range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for cultivated crops, range, and as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Cultivated crops

The major management concerns when using the soils for cultivated crops are described in this section. In addition, the crops best adapted to the soils in the survey area are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yeilds of the main crops are presented for each soil.

This section provides information about the overall agricultural potential and needed practices in the survey area for farmers, equipment dealers, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." When making plans for management systems for individual fields or farms, check the detailed information given in the description of each soil.

In 1967, about 7,286 acres in the survey area were used as cropland, according to the Conservation Needs Inventory (*3*).

The most restrictive factor limiting the use of the soils of Sterling County for cultivated crops is low rainfall. The potential of the soils for increased production of food is high, but lack of rainfall and irrigation water restricts use of many of the soils to range.

Other management concerns are the hazards of water erosion and soil blowing. Water erosion is a hazard on the loamy, gently sloping Angelo, Broome, Mereta, Olton, and Reagan soils. Runoff can damage these soils if they are not protected. Vegetative cover and mechanical measures, such as contour farming, terraces, and grassed waterways, help minimize water erosion on these soils. Soil blowing is a moderate hazard on the loamy or clayey Lipan, Reagan, and Tobosa soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Loss of the surface layer by water erosion or soil blowing is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils which have a layer that limits the depth of the root zone, such as the layers of indurated caliche in Mereta soils. Second, water erosion on farmland results in sedimentation. Control of water erosion minimizes sedimentation and improves the quality of water for municipal use, for recreation, and for fish and wildlife. Soil blowing results in pollution of the air. It also deposits drifts of productive soil material along fence rows, in bar ditches, and across roads.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetation cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils.

Minimum tillage practices and those in which crop residue is left on or near the soil surface help increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the soils that have a clayey surface layer, such as the Lipan and Tobosa soils.

Emergency tillage helps control soil blowing when crop residue does not furnish adequate protection. This practice is used to roughen the soil surface so it will be more resistant to movement by the wind. Angelo, Broome, Lipan, Mereta, Olton, Reagan, Rioconcho, and Tobosa soils are suitable for emergency tillage.

Contour farming is also an erosion control practice used in the survey area. It is best adapted to soils that have smooth, uniform slopes, including most areas of the gently sloping Angelo, Broome, Mereta, Olton, and Reagan soils.

Grassed waterways minimize soil erosion by concentrated runoff water. They are also good outlets for terraces or diversions.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Angelo, Olton, and Reagan soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of irregular slopes; high concentration of calcium carbonate at a depth of less than 30 inches, as in Broome soils; or indurated caliche at a depth of less than 30 inches, as in Mereta soils.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is a management need on the somewhat poorly drained Lipan soils, which make up about 1,180 acres in the survey area.

Soil fertility is naturally medium to low in most of the cultivated soils on uplands in the survey area. Additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply. None of the soils require additions of lime.

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

Most of the soils used for cultivated crops in the survey area are loamy and can be plowed in fall. However, some of the gently sloping, loamy soils are subject to damaging water erosion if they are plowed in fall. Also, maintenance of residue on or near the soil surface is important for the soils that are subject to soil blowing.

Lipan soils and Tobosa soils are clayey, and tilth is a concern. If they are wet when plowed, they tend to be very cloddy when they dry, and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in spring. Soil blowing is a concern if these soils are left bare.

Field crops suited to the soils and climate of the survey area include grain sorghum, wheat, and oats. Grain sorghum is a row crop, and wheat and oats are close-growing crops.

Special crops include mainly vegetables and nursery plants. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables. Production is limited mainly by amount of rainfall or availability of irrigation water.

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

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or for engineering purposes.

In the capability system (*5*), all kinds of soil are grouped at two levels: capability class and subclass. 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; they are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production. (None in Sterling County)

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 too cold or too 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, though they have other limitations that restrict their use to pasture, range, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 4. All soils in the survey area are included. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay yields were estimated for alfalfa. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils 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 included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Range

R. J. PEDERSON AND KENNETH D. SPARKS, range conservationists, Soil Conservation Service, helped plan and write this section.

Range is land on which the natural potential plant community of the soil is composed of grasses, forbs, and shrubs valuable for grazing. About 567,342 acres in the survey area were used for range in 1967, according to the Conservation Needs Inventory (*3*). This acreage was used for the production of native vegetation and was grazed by domestic livestock and wildlife.

Acreage in range and the number of operating units have gradually decreased over the years. There are about 102 ranches and farms producing livestock in the county. Most livestock operations are cow-calf and ewe-lamb.

Most of the soils in the county produce a mixture of plants suitable for grazing by cattle and sheep. Deer, wild turkey, and other wildlife are increasing in number and value, but they use only a small part of the forage produced.

Where climate and topography are about the same, differences in the kind and amount of vegetation that range can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the potential production of vegetation in favorable, normal, and unfavorable years; the common plant names; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of range that differs from other kinds of range in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction is also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well-managed range that is supporting the potential natural plant community. 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 are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plant names are given for the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluaton of the present condition of the range vegetation in relation to its potential. 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. 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 maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat and protects soil and water resources.

The soils on the limestone hills throughout the county produce shin oak and browse plants as well as grasses and forbs. These areas are well suited to use by sheep and cattle. The deeper soils in the valleys and lower lying plains have high potential for mixed medium and short grasses as well as some forbs and woody plants. Mesquite has increased and invaded on the deeper soils. Cedar has increased on the shallow and very shallow soils.

Growth of native vegetation is greatest during May and June when rainfall and temperature are favorable for growth. Additional growth usually occurs during September and October. The soils on bottom lands produce some grasses that grow in cool seasons as well as those that grow in warm seasons. This is of particular value for year-long forage.

The major management concern on most of the range is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Controlling brush and minimizing soil blowing are also important management concerns. If sound range management based on the soil survey information and range inventories is applied, the potential is good for increasing the productivity of range in the area.

Engineering

EUGENE R. LINDEMANN, engineer, Soil Conservation Service, helped plan and write this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this section are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to: (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity, in-place density, and soil wetness were also considered. Soil wetness indicates potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, the size of the absorption field could be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill refers to a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness may be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

In the trench type of landfill, ease of excavation also affects the suitability of a soil for this purpose, so the soil must be deep to bedrock and free of large stones and boulders.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil and covered daily with topsoil. The limitations caused by soil texture, depth to bedrock, and content of stones do not apply to this type of landfill. Soil wetness, however, can be a limitation because of difficulty in operating equipment.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; loamy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slopes, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, and need for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

JAMES HENSON, biologist, Soil Conservation Service, helped plan and write this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, wheat, oats, and barley. The major soil properties 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.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are Kleingrass, sorghum almum, weeping lovegrass, Texas panicum, sweetclover, vetch, winter peas, crownvetch, and alfalfa. Major soil properties 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.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, buffalograss, croton, vine-mesquite, Texas wintergrass, peavine, milk vetch, primrose, verbena, and gramas. Major soil properties 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.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are shin oak, dalea, sumac, ephedra, yucca, condalia, and catclaw. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, scaled quail, dove, meadowlark, field sparrow, cottontail rabbit, pronghorn antelope, and red fox.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include pronghorn antelope, white-tailed deer, jackrabbit, skunk, coyote, bobcat, badger, javelina, scaled quail, dove, wild turkey, meadowlark, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classification, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present pertinent soil and water features and engineering test data.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 in the standard terms used by the U.S. Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 16. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep to deep, moderately well drained to 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the soil mapping. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Engineering test data

Table 16 contains the results of engineering tests performed by the Texas Highway Department on some of the soils in Sterling County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine the mechanical analysis and other properties significant in engineering.

As moisture is removed, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium, called the *shrinkage limit*, is reached. At this point shrinkage stops, although additional moisture is removed. Shrinkage limit is reported as the precentage of moisture in ovendry soil.

Linear shrinkage is the decrease in one dimension of the soil mass that occurs when the moisture content is reduced from the liquid limit to the shrinkage limit. It is expressed as a precentage of the original dimension.

Shrinkage ratio is the volume change that results from the drying of soil material divided by the moisture loss caused by drying. It is expressed numerically.

Mechanical analysis shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass the No. 200 sieve, as do the finer silt and clay particles.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from solid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Classification of the soils in the AASHTO and Unified systems is based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits.

Classification of the soils

In this section, the soil series recognized in the survey area are described, the current system of classifying soils is defined, and the soils in the area are classified according to the current system.

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (4). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Angelo series

The Angelo series consists of deep, loamy soils on uplands. These soils formed in calcareous, clayey and loamy sediments mainly from ancient stream terraces. Slopes range from 0 to 3 percent.

Typical pedon of Angelo silty clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 0.7 mile north on Texas Highway 158, 0.3 mile west on a county road, and 792 feet north, in range:

A11—0 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; many worm casts; few concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

A12—8 to 14 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; weak fine granular and moderate fine subangular blocky structure; hard, friable; many fine roots; few worm casts; few concretions and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B21—14 to 29 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few worm casts; few threads and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B22ca—29 to 44 inches; pink (7.5YR 7/4) silty clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; hard, friable; few worm casts; about 35 percent soft bodies of calcium carbonate and 5 percent concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—44 to 58 inches; pink (7.5YR 7/4) silty clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; hard, friable; about 40 percent soft bodies of calcium carbonate and 10 percent concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B24ca—58 to 80 inches; pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; weak fine subangular blocky structure; hard, friable; about 30 percent rounded limestone fragments and conglomerate with caliche coatings; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 24 to 40 inches.

The A horizon ranges from 10 to 20 inches in thickness. It is brown, dark brown, grayish brown, or dark grayish brown. The A12 horizon is clay loam, silty clay loam, clay, or silty clay.

The B2 horizon is clay loam, silty clay loam, clay, or silty clay and has clay content of 35 to 55 percent. The part of the B2 horizon above the calcic horizon is grayish brown or brown. The B2ca horizon is pink, reddish yellow, or yellowish red. Soft bodies and weakly cemented concretions of calcium carbonate make up 20 to 50 percent, by volume, of the B2ca horizon.

Berda series

The Berda series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediments, mainly alluvium. Slopes range from 1 to 8 percent.

Typical pedon of Berda loam in an area of Berda soils, undulating; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 10 miles north on Texas Highway 158, 4.25 miles north on county road, and 225 feet east, in range:

A1—0 to 10 inches; reddish brown (5YR 5/3) loam, reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few fine roots; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—10 to 24 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few fine roots; few concretions and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—24 to 58 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few soft bodies of calcium carbonate and pebbles of caliche 1/4 to 1 inch across; calcareous; moderately alkaline; diffuse smooth boundary.

Cca—58 to 80 inches; pink (5YR 7/4) loam, reddish brown (5YR 5/4) moist; massive; slightly hard, friable; about 20 percent soft bodies of calcium carbonate and 10 percent fragments of caliche 1/2 to 1-1/2 inches across; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. It is moderately alkaline throughout.

The A horizon ranges from 6 to 12 inches in thickness. It is reddish brown or brown. Texture is fine sandy loam, loam, or clay loam.

The B horizon is light reddish brown, reddish brown, pink, or light brown. Texture is loam, sandy clay loam, or clay loam. Content of visible calcium carbonate in the form of soft bodies, concretions, and threads ranges from 5 to 15 percent.

The C horizon is light reddish brown, reddish brown, pink, or light brown. Texture is loam, sandy clay loam, or clay loam.

Broome series

The Broome series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediments of ancient outwash and eolian origin. Slopes range from 1 to 3 percent.

Typical pedon of Broome silty clay loam, 1 to 3 percent slopes; from the Sterling County Courthouse, 1 mile west on U.S. Highway 87 and 135 feet south, in range:

A—0 to 7 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine and medium roots; few threads and films of calcium carbonate; few insect burrows; calcareous; moderately alkaline; clear wavy boundary.

B21tca—7 to 18 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; few clay films; few threads, films, and soft bodies of calcium carbonate; few insect burrows; calcareous; moderately alkaline; gradual wavy boundary.

B22tca—18 to 39 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable; few faintly evident clay films; about 30 percent by volume soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—39 to 80 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; weak fine subangular blocky structure;

hard, friable; few clay films; about 10 percent by volume soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon ranges from 6 to 9 inches.

The A horizon is reddish brown, brown, or pinkish gray. When moist value and chroma are less than 3.5, the A horizon is less than 7 inches thick.

The B2tca horizon is clay loam or silty clay loam and has silicate clay content of 22 to 35 percent. Calcium carbonate makes up 5 to 50 percent, by volume, of this horizon. The B2tca horizon is reddish brown, light reddish brown, light brown, brown, yellowish red, reddish yellow, or pink.

Cobb series

The Cobb series consists of moderately deep, loamy soils on uplands. These soils formed in materials weathered from sandstone. Slopes range from 1 to 8 percent.

Typical pedon of Cobb fine sandy loam in an area of Cobb association, undulating; from the intersection of U.S. Highway 87 and cemetery road in Sterling City, 0.55 mile south on cemetery road, east through cattle guard, 3.1 miles south on ranch road, and 50 feet west, in range:

A—0 to 6 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; neutral; gradual smooth boundary.

B21t—6 to 17 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; few fine roots; neutral; clear wavy boundary.

B22t—17 to 26 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; very hard; friable; neutral; abrupt wavy boundary.

C—26 to 40 inches; weakly cemented to strongly cemented reddish yellow sandstone.

The solum ranges from 20 to 40 inches in thickness over red and yellow sandstone.

The A horizon ranges from 5 to 12 inches in thickness and is reddish brown or brown. It is slightly acid to neutral.

The Bt horizon is reddish brown, red, or yellowish red. It ranges from sandy clay loam to clay loam and has clay content of 22 to 35 percent.

The C horizon is weakly cemented to strongly cemented sandstone and registers hardness of about 2 on Mohs' scale.

This soil is a taxadjunct to the Cobb series. The Cobb series is typified in a slightly more moist moisture regime, but because of its limited extent in this survey area, a new series was not proposed. The color of the lower part of the B2t horizon is red (2.5YR 4/6), which is darker than allowed for the series. These differences, however, do not alter use, management, or behavior.

Colorado series

The Colorado series consists of deep, loamy soils on bottom lands. These soils formed in calcareous, loamy sediments of recent origin. Slopes range from 0 to 1 percent.

Typical pedon of Colorado loam in an area of Colorado soils, frequently flooded; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 10 miles northwest on U.S. Highway 87, 6.1 miles north on county road, and 285 feet west, in range:

A—0 to 9 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine granular and subangular blocky structure; hard, friable; few fine roots; few fine pores; few worm casts; bedding planes of sand and small rounded pebbles at a depth of 7 to 9 inches; calcareous; moderately alkaline; abrupt smooth boundary.

C1—9 to 35 inches; light reddish brown (5YR 6/4) loam, reddish brown (5YR 5/4) moist; massive; hard, friable; few worm casts; few insect burrows; silt loam and fine sandy loam bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—35 to 80 inches; reddish brown (5YR 5/4) loam, yellowish red (5YR 4/6) moist; massive; slightly hard, friable; visible bedding planes of sand and small rounded pebbles at a depth of 35 to 38 inches; calcareous; moderately alkaline.

The soil is more than 80 inches thick. It is moderately alkaline throughout. The 10-to 40-inch control section is 18 to 35 percent clay. More than 15 percent of the soil is coarser than very fine sand. The soil has less than 10 percent coarse fragments. Irregular distribution of organic matter and bedding planes of sand and water-worn gravel are evident in the control section and below. The soil is stratified throughout.

The A horizon ranges from 5 to 13 inches in thickness. It is light reddish brown, reddish brown, or brown. It is loam, fine sandy loam, or silt loam.

The C horizon is light reddish brown, reddish brown, or yellowish red. It is loam, silt loam, or fine sandy loam.

Conger series

The Conger series consists of shallow, loamy soils on uplands. These soils formed in calcareous, loamy materials. Slopes range from 1 to 3 percent.

Typical pedon of Conger loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 87 and Texas Highway 163 in Sterling City, 2.4 miles south on Texas Highway 163, and 285 feet east, in range:

A1—0 to 5 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; few fragments of caliche 1/8 to 3/4 inch across; calcareous; moderately alkaline; clear smooth boundary.

B2—5 to 14 inches; brown (10YR 5/3) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; about 8 percent by volume fragments of caliche 1/4 inch to 2 inches across; calcareous; moderately alkaline; abrupt wavy boundary.

C1cam—14 to 24 inches; pinkish white (7.5YR 8/2) strongly cemented caliche plates about 4 to 10 inches in diameter, upper 1/2 inch is laminar; calcareous; moderately alkaline; abrupt wavy boundary.

C2ca—24 to 50 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; massive; slightly hard, friable; about 70 percent soft bodies of calcium carbonate and fragments of caliche 1/2 to 2 inches across; calcareous; moderately alkaline; clear smooth boundary.

C3ca—50 to 80 inches; light brown (7.5YR 6/4) clay loam, strong brown (7.5YR 5/6) moist; massive; hard, friable; about 20 percent by volume soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness. It is moderately alkaline throughout.

The A horizon ranges from 4 to 6 inches in thickness. It is brown or grayish brown.

The B2 horizon is loam or clay loam. It is pale brown, light brown, or brown.

The C1cam horizon ranges from 10 to 30 inches in thickness. It is indurated to strongly cemented caliche.

The C2ca and C3ca horizons are loam or clay loam earth that is weakly cemented to strongly cemented. They are white, light brown, pink, or pinkish white.

Dev series

The Dev series consists of deep, loamy, very gravelly soils on bottom lands. These soils formed in calcareous, loamy sediments of recent origin. Slopes range from 0 to 2 percent.

Typical pedon of Dev very gravelly loam in an area of Dev and Rioconcho soils; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 10 miles northwest on Texas Highway 158, 3.2 miles north on county road, and 85 feet east, in range:

A1—0 to 24 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky and weak granular structure; hard, friable; few fine roots; few fine pores; about 70 percent by volume subrounded limestone fragments 1/8 inch to 3 inches across; few subrounded limestone cobbles and stones; calcareous; moderately alkaline; diffuse wavy boundary.

C—24 to 80 inches; brown (7.5YR 5/2) very gravelly loam, brown (7.5YR 4/2) moist; massive; hard, friable; few fine roots; about 80 percent by volume subrounded limestone fragments 1/8 inch to 3 inches across; few subrounded limestone cobbles and stones; common 1/2 inch strata of gravel with about 10 percent soil; calcareous; moderately alkaline.

The soil ranges from 48 to more than 80 inches in thickness. The 10- to 40-inch control section contains 35 to 90 percent, by volume, limestone pebbles 1/8 inch to 3 inches across, and a few cobbles and stones. Texture of the fine earth fraction within the control section is fine sandy loam, loam, or clay loam. Clay content is 18 to 35 percent in the control section. Content of carbonates smaller than 20 millimeters ranges from 40 to 70 percent, by volume, throughout.

Thickness of the A horizon ranges from 20 to 35 inches. It is dark grayish brown, grayish brown, or brown. Texture of the fine earth fraction is loam or clay loam.

The C horizon is brown, yellowish brown, pale brown, or very pale brown. It is fine sandy loam, loam, or clay loam.

Ector series

The Ector series consists of shallow or very shallow, loamy, very gravelly soils on uplands. These soils formed in limestone deposits on plateaus and erosional landscapes. Slopes range mainly from 1 to 30 percent.

Typical pedon of Ector very gravelly loam in an area of Ector association, hilly; from the intersection of U.S. Highway 87 and Texas Highway 163 in Sterling City, 1.7 miles south on Texas Highway 163, and 500 feet west, in range:

A1—0 to 17 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; about 40 percent by volume limestone fragments less than 3 inches across and about 25 percent by volume limestone fragments 3 to 7 inches across; limestone and caliche fragments cover about 40 percent of the soil surface; calcareous; moderately alkaline; abrupt wavy boundary.

R&Cca—17 to 25 inches; very pale brown (10YR 8/3) fractured limestone and indurated caliche plates with hardness of more than 3 on Mohs' scale; limestone fragments and plates have 1/8 to 3/8 inch coatings of secondary carbonates on the upper surfaces and common nodular pendants on lower surfaces; calcareous; moderately alkaline; gradual wavy boundary.

R—25 to 80 inches; fractured limestone bedrock with hard calcium carbonate precipitate in seams and fractures.

Thickness of the solum or depth to limestone bedrock ranges from 4 to 20 inches.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown very gravelly loam or very gravelly clay loam. Limestone fragments make up 35 to 80 percent, by volume, of the A horizon. The calcium carbonate equivalent is 40 to 80 percent of the volume of soil material less than 20 millimeters across.

The R&Cca horizon ranges from 6 to 12 inches in thickness.

The R layer is several feet thick.

Kimbrough series

The Kimbrough series consists of very shallow to shallow, loamy, gravelly soils on uplands. These soils formed over caliche that has hardened in the upper part. Slopes range from 1 to 8 percent.

Typical pedon of Kimbrough gravelly loam in an area of Kimbrough and Potter soils, undulating; from the intersection of U.S. Highway 87 and Texas Highway 163 in Sterling City, 1.25 miles south on Texas Highway 163, 250 feet west on ranch road, and 100 feet south, in range:

A1—0 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky and weak granular structure; slightly hard, friable; many fine roots; about 25 percent by volume caliche fragments 1/8 inch to 2 1/2 inches across; calcareous; moderately alkaline; abrupt wavy boundary.

C1cam—9 to 24 inches; white (10YR 8/2) indurated and strongly cemented caliche that breaks to platy fragments; some plates are laminar in the upper 1/8 inch; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—24 to 80 inches; pink (7.5YR 8/4) loam, pink (7.5YR 7/4) moist; massive; hard, friable; caliche is softer than in the C1cam horizon; about 33 percent strongly cemented caliche fragments; calcareous; moderately alkaline.

The solum ranges from 4 to 17 inches in thickness.

The A horizon is dark grayish brown, grayish brown, or brown. It is gravelly loam or gravelly clay loam and has clay content of 20 to 30 percent. The A horizon is about 15 to 35 percent coarse fragments.

The C1cam horizon ranges from 4 to 20 inches in thickness, is strongly cemented, and is laminar in the upper 1/2 inch in places.

The C2ca horizon is pink or pinkish white loam or clay loam. It is about 40 to 70 percent visible calcium carbonate.

Lipan series

The Lipan series consists of deep, clayey soils in enclosed depressions (playas). These soils formed in calcareous, clayey sediments. Slopes range from 0 to 1 percent.

Typical pedon of Lipan clay, depressional; at the center of a microdepression, from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 8 miles northwest on Texas Highway 158, and 425 feet north, in range:

A11—0 to 5 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; mulch of very fine granular structure 1 1/2 inches thick on surface; few concretions of calcium carbonate as much as 1/4 inch in diameter; shiny ped faces; calcareous; moderately alkaline; clear smooth boundary.

A12—5 to 16 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine blocky structure; very hard, very firm, very sticky and plastic; few fine roots, few concretions of calcium carbonate as much as 1/4 inch in diameter; shiny ped faces; calcareous; moderately alkaline; gradual wavy boundary.

AC—16 to 60 inches; grayish brown (10YR 5/2) clay, dark gray (10YR 4/1) moist; weak medium blocky structure; very hard, very firm, very sticky and plastic; few concretions of calcium carbonate as much as 1/4 inch in diameter; shiny faces on wedge-shaped peds; tilted intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

Cca—60 to 80 inches; brown (7.5YR 5/2) clay, brown (7.5YR 4/2) moist; massive; very hard, very firm, very sticky and plastic; few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 66 inches in thickness. It is mildly alkaline or moderately alkaline.

Undisturbed areas are dominated by gilgai microrelief, which consists of microknolls 3 to 10 inches higher than the microdepressions. Distance between the centers of the microknolls and the centers of the microdepressions is 3 to 20 feet. When the soil is dry, cracks 1 to 2 inches wide extend from the surface into the AC horizon. Intersecting slickensides are at a depth of about 20 to 30 inches.

The A horizon ranges from 15 to 32 inches in thickness. It is gray or dark gray.

The AC horizon is clay or silty clay and has clay content of 40 to 60 percent. It is gray, grayish brown, or light brownish gray.

The Cca horizon is gray, light brownish gray, brown, or pale brown. Calcium carbonate makes up from 2 to 35 percent, by volume, of the Cca horizon.

Mereta series

The Mereta series consists of shallow, loamy soils on uplands. These soils formed in loamy caliche that has hardened in the upper part. Slopes range from 0 to 3 percent.

Typical pedon of Mereta clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 10 miles northwest on Texas Highway 158, 1.3 miles north on county road, and 175 feet east, in range:

A11—0 to 6 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky and weak granular structure; hard, friable; many fine roots; few worm casts; few caliche pebbles; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 15 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky and weak granular structure; hard, firm; few fine roots; about 5 percent caliche pebbles 1/8 to 1 inch in diameter; calcareous; moderately alkaline; abrupt wavy boundary.

C1cam—15 to 24 inches; pinkish white (7.5YR 8/2) strongly cemented caliche plates; pink (7.5YR 8/4) clay loam in cracks, which make up 3 percent of horizon; clear wavy boundary.

C2ca—24 to 78 inches; pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; massive; about 35 percent soft bodies and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum or depth to the C1cam horizon ranges from 14 to 20 inches. The solum is moderately alkaline throughout.

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

The C1cam horizon ranges from 8 to 25 inches in thickness. It is indurated to strongly cemented caliche. It is white or pinkish white.

The C2ca horizon is loam or clay loam earth that contains weakly cemented to strongly cemented caliche. It is white, pink, pinkish white, or pinkish gray.

Olton series

The Olton series consists of deep, loamy soils on uplands. These soils formed in ancient outwash. Slopes range from 1 to 3 percent.

Typical pedon of Olton clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 87 and cemetery road in Sterling City, 0.55 mile south on cemetery road, east through cattle guard, 2.6 miles south on ranch road, and 150 feet west, in range:

A1—0 to 7 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine granular and moderate medium subangular blocky structure; hard, friable; many fine roots; few fine pores; neutral; gradual wavy boundary.

B21t—7 to 16 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; few insect burrows; neutral; gradual wavy boundary.

B22t—16 to 32 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak medium blocky structure; very hard, firm; few threads and films of calcium carbonate; patchy clay films on ped faces; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—32 to 56 inches; pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; weak fine blocky structure; hard, firm; about 30 percent soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B24tca—56 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak fine subangular blocky structure; hard, firm; about 20 percent soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The mollic epipedon is 11 to 20 inches thick. It includes the A horizon and the upper part of the B horizon.

The A horizon ranges from 6 to 12 inches in thickness. It is dark brown, brown, or reddish brown. Reaction is neutral to mildly alkaline.

The B21t and B22t horizons are reddish brown or brown. They are clay loam or clay, and clay content ranges from 35 to 45 percent.

Depth to the B2tca horizon, or the calcic horizon, ranges from 30 to 46 inches. The B2tca horizon is pink, light reddish brown, light brown, reddish yellow, or reddish brown. It is clay or clay loam. Calcium carbonate content ranges from 20 to 50 percent.

Owens series

The Owens series consists of shallow, clayey soils on uplands. These soils formed in calcareous clays and shales. Slopes range from 1 to 8 percent.

Typical pedon of Owens clay in an area of Kimbrough-Owens association, undulating; from the intersection of U.S. Highway 87 and cemetery road in Sterling City 0.55 mile south on cemetery road, 0.3 mile east on ranch road, and 0.35 mile southwest, in range:

A1—0 to 5 inches; reddish brown (2.5YR 4/4) clay, dark red (2.5YR 3/6) moist; weak fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—5 to 15 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few threads, films, and soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—15 to 80 inches; light reddish brown (2.5YR 6/4) shaly clay, reddish brown (2.5YR 4/4) moist; massive; extremely hard, extremely firm; few soft bodies of calcium carbonate; dark colored or black stains on rocklike fragments of shaly clay; calcareous; moderately alkaline.

Thickness of the solum or depth to shaly clay ranges from 12 to 20 inches. The soil is moderately alkaline throughout. Clay content of the soil ranges from 35 to 50 percent.

The A horizon ranges from 4 to 8 inches in thickness. It is reddish brown, weak red, light reddish brown, or brown.

The B2ca horizon is reddish brown or red. Calcium carbonate accumulations range from few to about 5 percent, by volume.

The C horizon is light reddish brown or reddish brown. Shale in some pedons contains black stains of dendritic pattern on the ped fragments.

Potter series

The Potter series consists of very shallow, loamy, gravelly soils on uplands. These soils formed in beds of caliche. Slopes range from 1 to 8 percent.

Typical pedon of Potter gravelly loam in an area of Kimbrough and Potter soils, undulating; from the intersection of U.S. Highway 87 and cemetery road in Sterling City, 0.55 mile south on cemetery road, 1.25 miles southeast and 1.1 miles east on ranch road, and 450 feet north, in range:

A1—0 to 7 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; many fine roots; about 15 percent by volume caliche fragments 1/8 inch to 2 inches across; many caliche fragments 1/8 inch to 2 inches across on the surface; calcareous; moderately alkaline; abrupt wavy boundary.

C1ca—7 to 19 inches; pinkish white (7.5YR 8/2) fractured platy fragments of caliche with hardness of less than 3 on Mohs' scale; can be cut with a spade; plates have calcium carbonate pendants on underside; few fine roots between the plates and fragments; calcareous; moderately alkaline; clear smooth boundary.

C2ca—19 to 80 inches; pinkish white (7.5YR 8/2) caliche of loam texture; 20 percent caliche pebbles and fragments 1/4 inch to 1 1/2 inches in size; 30 percent soft powdery caliche containing few pockets of light brown (7.5YR 6/4) clay loam at a depth of 44 inches; calcareous; moderately alkaline.

Thickness of the solum or depth to the Cca horizon ranges from 4 to 11 inches. The soil is moderately alkaline throughout.

The A horizon is brown, pale brown, light brown, grayish brown, or light brownish gray. Clay content ranges from about 15 to 35 percent.

The Cca horizon is white or pinkish white caliche that is slightly platy in the upper part.

Reagan series

The Reagan series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy sediments of ancient outwash and eolian origin. Slopes range from 0 to 3 percent.

Typical pedon of Reagan silty clay loam, 1 to 3 percent slopes; from the Sterling County Courthouse, 15.8 miles west on U.S. Highway 87, 1.45 miles south on ranch road, and 170 feet west, in range:

A11—0 to 4 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; many fine roots; many fine pores; platy surface crust; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 9 inches; brown (7.5YR 5/2) silty clay loam, brown (7.5YR 4/2) moist; weak fine and medium subangular blocky structure; hard, friable; many fine roots; few fine pores; few threads and films of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 20 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine pores; few concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B22—20 to 34 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak fine subangular structure; hard, friable; few threads, films, and about 3 percent soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—34 to 52 inches; pink (7.5YR 7/4) silty clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; hard, friable; about 35 percent by volume weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B24ca—52 to 80 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; weak subangular blocky structure; hard, friable; about 15 percent, by volume, weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. It is moderately alkaline throughout. Depth to the calcic horizon, or B2ca horizon, ranges for 20 to 40 inches.

The A horizon ranges from 6 to 12 inches in thickness. It is light brown, pale brown, brown, grayish brown, or dark brown. When moist value and chroma are less than 3.5, the A horizon is less than 7 inches thick. The B2 horizon is silty clay loam or clay loam and has clay content of 18 to 35 percent in the control section. The B2 part of the horizon above the calcic horizon is light brown, pale brown, or brown. The B2ca horizon is pink, pinkish white, reddish yellow, or light brown. Calcium carbonate content in the B2ca horzion ranges from 15 to 60 percent, by volume.

Rioconcho series

The Rioconcho series consists of deep, loamy soils on bottom lands. These soils formed in calcareous, clayey and loamy alluvial sediments. Slopes range from 0 to 2 percent.

Typical pedon of Rioconcho silty clay loam; from the intersection of U. S. Highway 87 and cemetery road in Sterling City, 0.55 mile south on cemetery road, 1.75 miles southeast on ranch road, and 15 feet west, in range:

A11—0 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; common fine roots; few worm casts and insect burrows; calcareous; moderately alkaline; diffuse smooth boundary.

A12—16 to 42 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate fine subangular blocky and moderate medium granular structure; hard, firm; few fine roots; few worm casts and insect burrows; calcareous; moderately alkaline; diffuse smooth boundary.

C1—42 to 78 inches; brown (7.5YR 5/4) silty clay, brown (7.5YR 4/4) moist; massive; hard, firm; few threads, films, and soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2—78 to 80 inches; pinkish gray (7.5YR 7/2) clay loam, pinkish gray (7.5YR 6/2) moist; massive; hard, friable; few soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 65 inches in thickness. When dry, this soil has cracks 1/2 to 1 inch wide that extend to a depth of 20 or 30 inches. The 10- to 40-inch control section is clay loam, silty clay loam, clay or silty clay and has clay content of 35 to 55 percent.

The A horizon ranges from 22 to 50 inches in thickness. It is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline.

The C horizon is brown, pale brown, grayish brown, light brownish gray, yellowish brown, or pinkish gray. It is silty clay, silty clay loam, or clay loam.

Sharvana series

The Sharvana series consists of shallow, loamy soils on uplands. These soils formed over thick beds of caliche. Slopes range from 1 to 8 percent.

Typical pedon of Sharvana fine sandy loam in an area of Kimbrough-Sharvana association, undulating; from the intersection of U. S. Highway 87 and cemetery road in Sterling City, 0.55 mile south on cemetery road, through cattle guard, 2.75 miles south, and 240 feet west, in range;

A1—0 to 5 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine medium subangular blocky structure; slightly hard, friable; few fine roots; few siliceous pebbles; neutral; clear smooth boundary.

B2t—5 to 18 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; few siliceous pebbles; noncalcareous; mildly alkaline; clear smooth boundary.

Ccam—18 to 30 inches; pinkish white (5YR 8/2) indurated caliche plates; pendants of calcium carbonate on lower side of plates; calcareous; moderately alkaline.

Thickness of solum or depth to indurated caliche ranges from 9 to 20 inches.

The A horizon ranges from 4 to 7 inches in thickness. It is reddish brown, light reddish brown or brown fine sandy loam or loamy fine sand.

The B2t horizon is dominantly reddish brown, but a few pedons are brown. It ranges from fine sandy loam to sandy clay loam and has clay content of 16 to 30 percent. It ranges from neutral to moderately alkaline. In some pedons the B2t horizon is calcareous in the lower part.

The Ccam horizon ranges from strongly cemented to indurated and contains a few laminations and fractures.

Tarrant series

The Tarrant series consists of very shallow to shallow, clayey, cobbly soils on uplands. These soils formed over limestone bedrock. Slopes range mainly from 10 to 30 percent.

Typical pedon of Tarrant cobbly clay in an area of Tarrant-Rock outcrop association, hilly; from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 5.4 miles northeast on Texas Highway 158, and 350 feet south, in range:

All—0 to 6 inches; very dark grayish brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; moderate medium granular and strong fine subangular blocky structure; very hard, very firm, plastic; many fine roots; few fine pores; about 70 percent fragments of limestone 1/4 inch to 15 inches across; calcareous; moderately alkaline; clear wavy boundary.

A12Ca—6 to 12 inches; dark grayish brown (10YR 4/2) cobbly clay, very dark brown (10YR 2/2) moist; weak fine granular and moderate fine subangular blocky structure; very hard, very firm, plastic; many fine roots in vertical and horizontal crevices; about 10 percent by volume clay soil in the interstitial spaces in the gravel, cobbles, and stones; coatings and pendants of calcium carbonate on cobbles and stones; calcareous; moderately alkaline; abrupt wavy boundary.

R—12 to 20 inches; white (10YR 8/2) fractured platy limestone bedrock; vertical and horizontal cracks 1/8 to 1/2 inch wide filled with brown (10YR 4/3) clay; roots extend into the cracks.

Thickness of the solum or depth to limestone bedrock ranges from 6 to 20 inches. Limestone fragments cover about 20 to 80 percent of the surface.

The A horizon is very dark grayish brown, dark grayish brown, or dark brown. It ranges from silty clay to clay and has clay content of 35 to 60 percent.

The R layer is several feet thick.

Tobosa series

The Tobosa series consists of deep, clayey soils on uplands. These soils formed in calcareous, clayey and loamy sediments. Slopes range from 0 to 1 percent.

Typical pedon of Tobosa clay, 0 to 1 percent slopes; at the center of a microflat, from the intersection of U.S. Highway 87 and Texas Highway 158 in Sterling City, 12.1 miles northeast on Texas Highway 158, 0.15 mile southeast on ranch road, and 20 feet north, in range:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium granular and moderate medium angular blocky structure; very hard, very firm, very sticky; many fine and medium roots; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 34 inches; dark grayish brown (10YR 4/2) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; very hard, very firm, very sticky; few fine roots; shiny pressure faces on peds; few intersecting slickensides below a depth of 24 inches; calcareous; moderately alkaline; gradual wavy boundary.

A13—34 to 48 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate fine and medium blocky structure; very hard, very firm, very sticky; shiny pressure faces on peds; wedge-shaped peds and few intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

AC—48 to 60 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate fine blocky structure; very hard, very firm, very sticky; about 4 percent by volume soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—60 to 80 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; hard, firm; about 10 percent by volume soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

In undisturbed areas, gilgai microrelief consists of microflats with microdepressions 4 to 12 inches deep and 2 to 4 feet across. When the soil is dry, cracks as wide as 1 inch extend from the surface into the AC horizon. Intersecting slickensides are at a depth of about 20 to 30 inches.

The A horizon ranges from 16 to 30 inches in thickness. It is brown, dark brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline.

The AC horizon is clay or silty clay and has clay contents of 40 to 60 percent. It is brown, dark brown, grayish brown, or dark grayish brown. It is mildly alkaline or moderately alkaline.

The Cca horizon is pink, pale brown, reddish yellow, or yellowish red. Visible calcium carbonate ranges from 5 to 25 percent, by volume.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, at the end of this section, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvents (*Fluv*, meaning flood plain sediments, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Ustifluvents (*Usti*, meaning limited moisture, plus *fluvent*, the suborder of Entisols that have formed in flood plain sediments).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, (calcareous), thermic Typic Ustifluvents.

SERIES. The series consists of a group of soils that are formed in a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition. An example is the Colorado series, a member of the fine-loamy, mixed (calcareous), thermic family of Typic Ustifluvents.

Formation of the soils

In this section the factors of soils formation are discussed and related to the formation of soils in Sterling County.

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geologic agencies. The characteristics of a soil at any given point depend on the physical and mineral composition of the parent material; the climate under which the soil material has accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil development have acted on the soil material.

All five of those factors are important in the genesis of every soil; some have had more influence than others in different locations. The factors are discussed in the following paragraphs.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. The soils of Sterling County have developed from parent materials of Permian, Cretaceous, and Quaternary or Recent ages.

Materials of Permian age influenced the soils in the extreme northeastern part of the county. The materials are red clay and red and yellow sandstone. Owens soils formed in the Permian red beds. The erodibility of these clays has caused these soils to be sloping, and the underlying shaly clay has limited the soil depth.

Materials of Cretaceous age are mainly interbedded limestone and calcareous marl of the Fredericksburg and Trinity groups. These materials cover most of the county, and Ector and Tarrant soils formed in them. These are gently sloping to steep, benched hills and ridges where the limestone bedrock is near the surface.

Materials of Quarternary age make up the valleys and outwash plains of the county. Soil that formed in outwash plains are Angelo, Brome, Conger, Kimbrough, Mereta, Olton, Reagan, and Tobosa soils. Materials of Quaternary age were deposited by water after streams had eroded through materials of Cretaceous age into materials of Permian age.

The parent material of the soils on the flood plains of rivers and intermittent streams of the county consists of alluvial deposits of Recent age. Many of these deposits on lower lying flood plains have been reworked from time to time, and new sediments have been deposited. Moderately alkaline soils that formed in these deposits are Dev, Rioconcho, and Colorado soils.

Climate

The climate of Sterling County is subtropical and fairly uniform. It has had a definite effect on soil formation. Rainfall, evaporation, temperature, and wind are some of the influencing factors of climate. The limited rainfall has not been great enough to leach the minerals from the soils. As a result, most of the soils have a layer in which calcium carbonate has accumulated. The deep soils are seldom wet below the root zone. The average annual rainfall is 18.38 inches.

Summer temperatures are high, and winter temperatures are usually moderate. The high temperatures and low rainfall have limited the accumulation of organic matter in the soils.

Plant and animal life

Plants, micro-organisms, earthworms, insects, animals, and even man have contributed to the development of soils. Gains or losses of organic matter, nitrogen, and plant nutrients, and changes in soil structure and porosity are some of the changes caused by living organisms.

Plants have played a major role in soil development in Sterling County. The fibrous root system of grasses contributed large amounts of organic matter to the soils. Roots of grasses, shrubs, and trees have decayed and left pores and holes that serve as passageways for water. Tree roots have loosened the stones beneath the surface and have made it possible for grass roots to penetrate to greater depths.

Earthworms, insects, rodents, and other animals have worked and mixed the soils to a great degree. Worms hasten the decay of organic matter, and worm casts improve the soil structure to aid the movement of water and growth of plant roots. Fungi, bacteria, and other micro-organisms help to decay organic matter and improve fertility.

The activities of man also have affected soil development. By fencing the range and allowing it to be overgrazed, man has changed the character of the vegetation. The grasses have become shorter, thinner, and weaker, and they return less organic matter to the soils. Tillage and other uses of soils have affected soil development. Construction and excavation activities are also likely to alter soil development.

Relief

Relief influences soil development through its effect on drainage and runoff. The topography of Sterling County ranges from nearly level to steep.

The degree of profile development depends on the amount and depth of penetration of moisture, if other factors of soil formation are equal. Nearly level soils absorb more moisture and usually have better developed profiles than steeper soils. Many of the steeper soils erode almost as fast as they form.

The deepest soils are Lipan and Tobosa soils. Soils of intermediate depth are the nearly level Angelo, Berda, Broome, Olton, and Reagan soils. Shallow development is exempified in the more sloping Conger and Mereta soils, and the least development is in the steep, very shallow Ector, Kimbrough, Owens, and Tarrant soils.

Time

A great length of time is required for the formation of soils with distinct horizons. The differences in length of time that parent materials have been in place are generally reflected in the degree of development of the soil profile.

The soils in Sterling County range from young to old. The young soils have very little profile development, and older soils have well expressed soil horizons. Colorado and Berda soils are examples of young soils which lack development. The darker Dev and Rioconcho soils show more development.

Some older soils are calcareous and have either a noticeable accumulation of calcium carbonate or a calcic horizon in the profile. Further aging leaches the calcium carbonate downward from the upper horizons to lower horizons in the form of soft masses or concretions. Angelo, Broome, and Reagan soils are exmples of soils that have calcium carbonate in the lower horizons. The calcium carbonate concentrates in the lower horizons, where it becomes cemented or indurated. Indurated or petrocalcic horizons require a great length of time for development, possibly millions of years. The Kimbrough and Mereta soils have petrocalcic horizons.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

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 frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

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 coat, clay skin.

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. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. 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 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

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 running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Favorable. Favorable soil features for the specified use.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

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. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

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.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming 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.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks 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 from which the solum is presumed to have 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.

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.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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. Inadequate strength for supporting 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.

Munsell notation. A designation of color by degrees of the three single 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.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

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.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree 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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground 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.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature 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 other plant and animal life characteristics of the soil 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.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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, to provide protection from soil blowing 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.

Surface soil. 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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. 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.

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, silt loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Illustrations

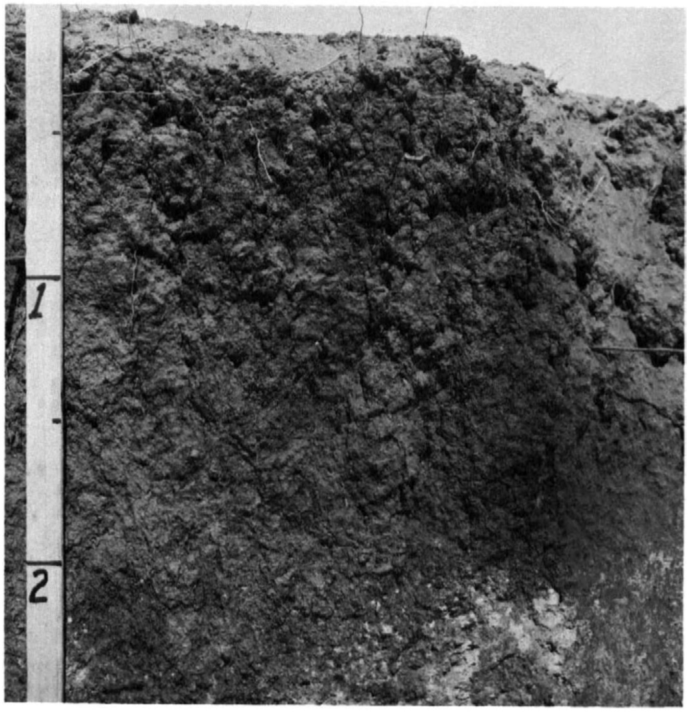

Figure 1.—Profile of Angelo silty clay loam. The horizon of calcium carbonate enrichment is at a depth of about 26 inches.

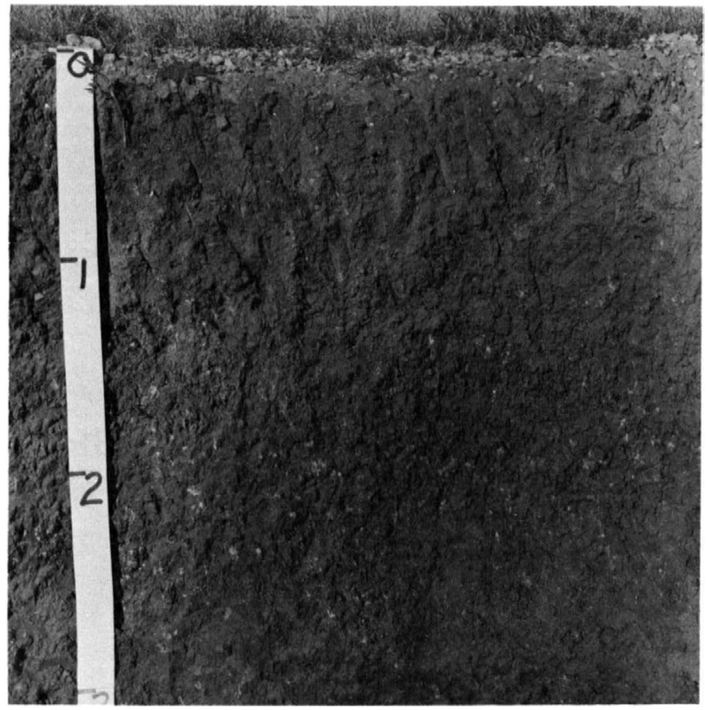

Figure 2.—Profile of Berda loam. The lower horizons have a few caliche pebbles and soft bodies of calcium carbonate.

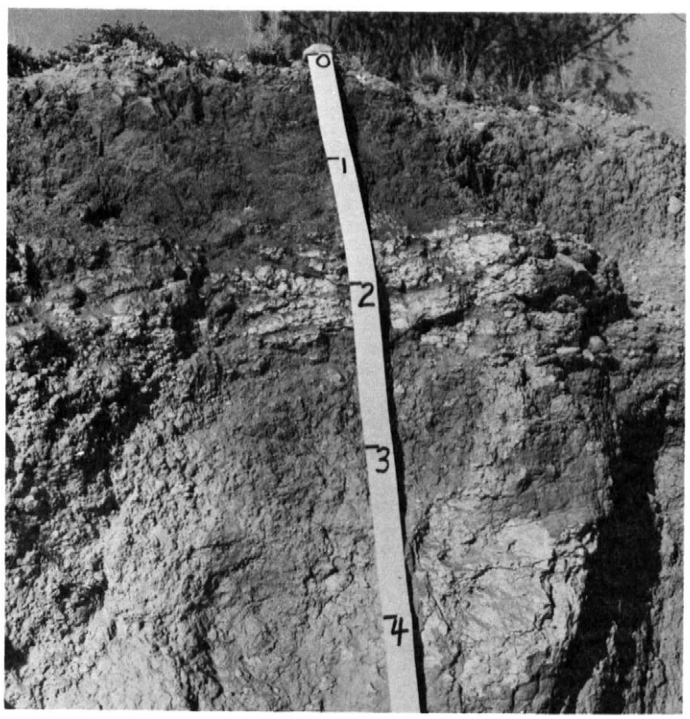

Figure 3.—Profile of Conger loam. A layer of strongly cemented caliche is between depths of 18 and 28 inches.

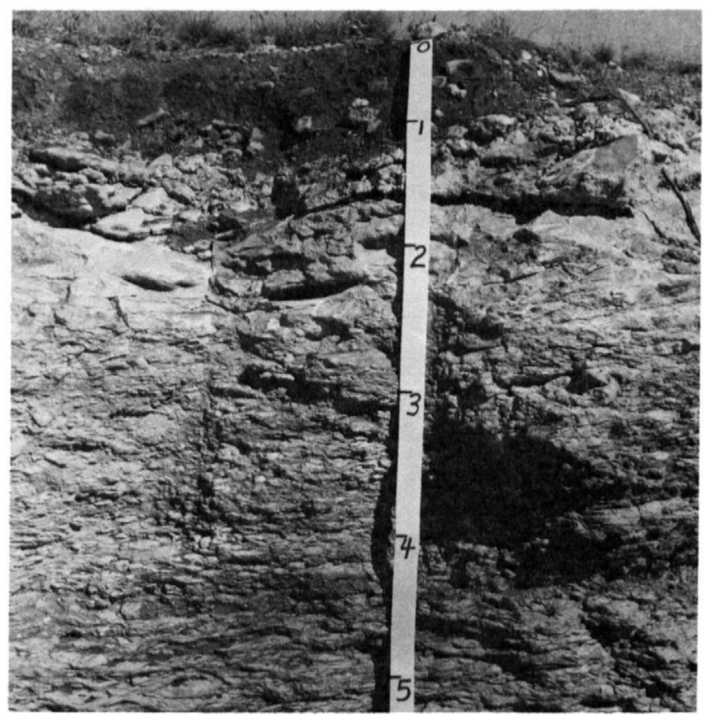

Figure 4.—Profile of Ector very gravelly loam in an area of Ector association, undulating. Depth to fractured limestone bedrock is 12 inches.

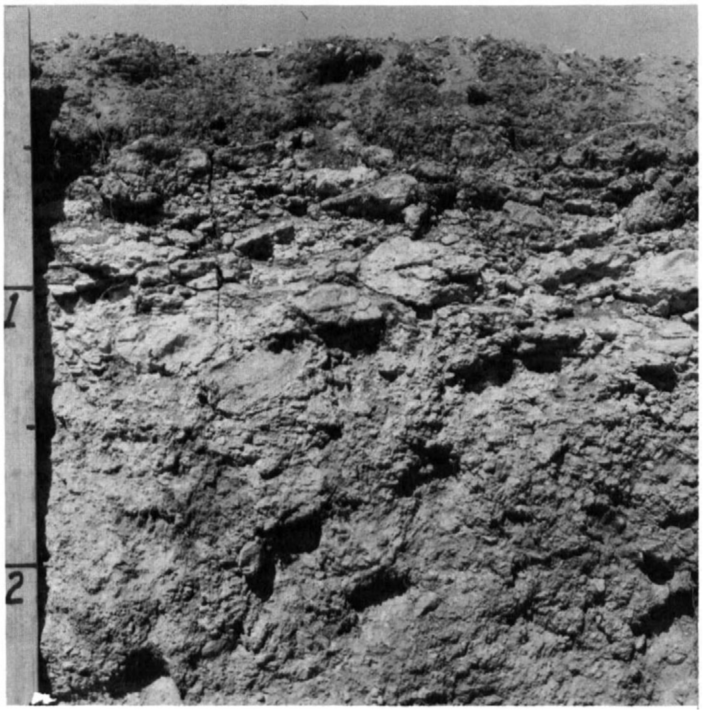

Figure 5.—Profile of Kimbrough gravelly loam in an area of Kimbrough and Potter soils, undulating. The surface layer rests abruptly on a layer of indurated caliche at a depth of 9 inches.

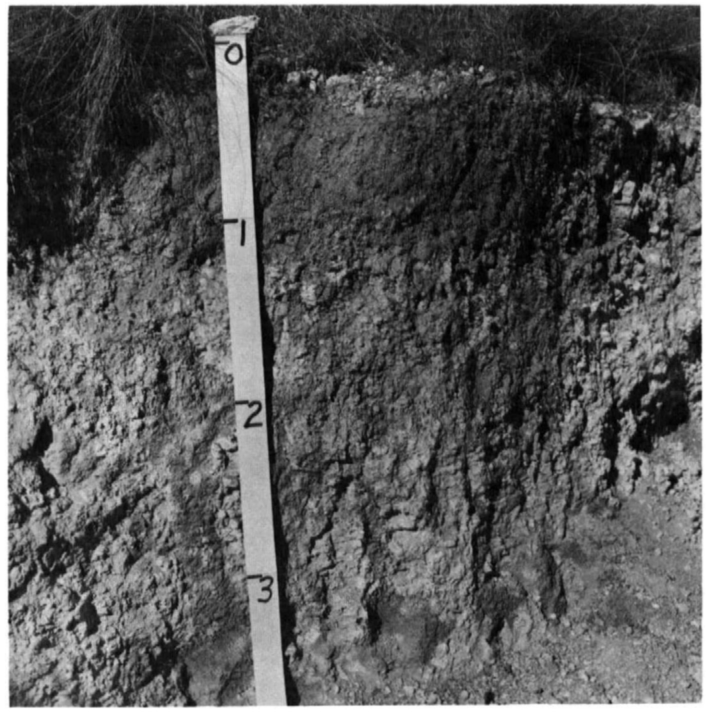

Figure 6.—Profile of Potter gravelly loam in an area of Kimbrough and Potter soils, undulating. Typically the surface layer is 7 inches thick over a layer of concentrated caliche fragments.

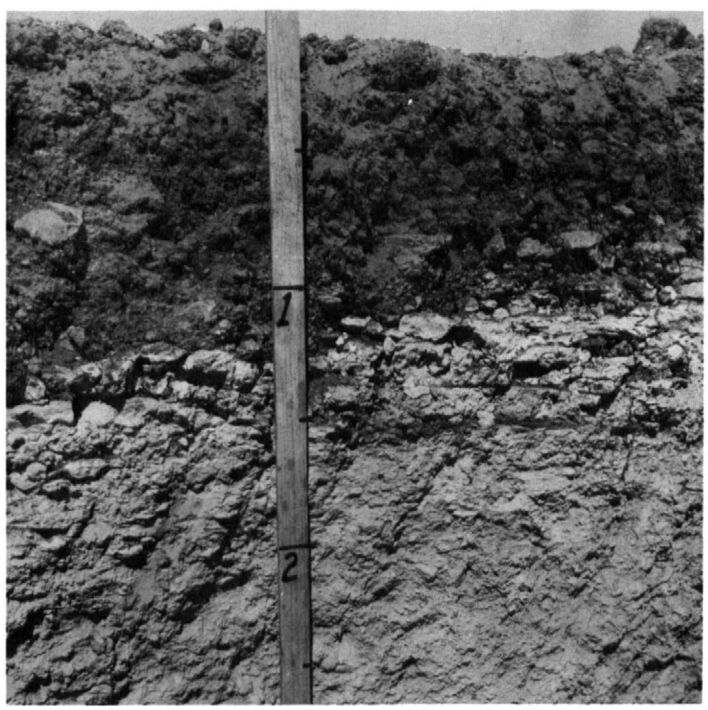

Figure 7.—Profile of Mereta clay loam. Depth to a layer of whitish indurated caliche is 14 inches.

Figure 8.—Reagan silty clay loam, 0 to 1 percent slopes, in an area of the Loamy range site.

Figure 9.—Profile of Rioconcho silty clay loam.

Figure 10.—Profile of Tarrant cobbly clay in an area of Tarrant-Rock outcrop association, hilly. Depth to fractured limestone bedrock is typically 12 inches.

Figure 11.—Tobosa clay, 0 to 1 percent slopes, in an area of the Clay Flat range site.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1954-70 at San Angelo Dam]

Month	Temperature								Precipitation			
	Average daily maximum	Average daily minimum	Average	Mean number of days with-- Maximum of-- 90 °F or higher	Mean number of days with-- Maximum of-- 32 °F or lower	Mean number of days with-- Minimum of-- 32 °F or lower	Mean number of days with-- Minimum of-- 0 °F or lower	Average number of heating degree days[1]	Average	Greatest daily	Average snow and sleet	Average number of days with 0.10 inch or more
	°F	°F	°F					Units	In	In	In	
January	57.1	30.5	43.8	0	2	19	0	665	0.92	1.73	0.2	2
February	60.9	34.3	47.6	(2)	1	13	0	502	0.98	1.90	0.1	3
March	68.3	40.7	54.5	1	(2)	7	0	350	0.71	1.10	0.3	2
April	79.6	53.0	66.3	5	0	(2)	0	95	2.01	2.15	0	3
May	85.5	60.8	73.2	11	0	0	0	18	2.64	2.14	0	3
June	92.3	68.0	80.2	22	0	0	0	2	1.81	2.99	0	3
July	95.8	71.4	83.6	27	0	0	0	0	1.08	2.73	0	2
August	95.2	70.0	82.6	27	0	0	0	0	1.71	2.85	0	3
September	87.6	64.0	75.8	13	0	0	0	6	2.74	3.62	0	4
October	78.5	53.3	65.9	3	0	(2)	0	91	1.93	3.09	0	3
November	67.0	41.6	54.3	0	(2)	5	0	330	1.14	1.80	0.4	3
December	60.0	33.6	46.8	0	(2)	15	0	567	0.71	1.37	0.1	2
Year	77.4	51.8	64.6	109	3	59	0	2,626	18.38	3.62	1.1	33

[1]Fifteen-year period of record (base 65 °F).
[2]Less than half a day.

TABLE 2.—POTENTIALS AND LIMITATIONS OF SOIL ASSOCIATIONS FOR SPECIFIED USES

Soil association	Extent of area	Cultivated farm crops	Specialty crops	Range	Urban uses	Recreation areas
Ector	38	Low: water erosion, slope, small stones, depth to rock.	Low: water erosion, slope, small stones, depth to rock.	Low: slope, small stones, depth to rock, water erosion.	Low: slope, small stones, depth to rock.	Medium: slope, small stones, depth to rock.
Angelo-Rioconcho-Broome	35	High: water erosion.	High: water erosion.	High: water erosion.	Low: shrink-swell, corrosivity, low strength, percs slowly, flooding.	Medium: too clayey, percs slowly, slope, flooding.
Mereta-Angelo	11	Medium: shallow depth, water erosion.	Low: shallow depth, water erosion.	Medium: shallow depth, available water capacity.	Medium: shallow depth, percs slowly, corrosivity.	Medium: shallow depth, too clayey.
Kimbrough-Potter	9	Low: slope, water erosion, shallow depth, small stones.	Low: slope, water erosion, shallow depth, small stones.	Low: shallow depth, available water capacity.	Low: slope, shallow depth, corrosivity.	Medium: shallow depth, small stones.
Conger-Reagan	5	Low: water erosion, soil blowing, shallow depth.	Low: water erosion, soil blowing, shallow depth.	Low: water erosion, shallow depth, available water capacity.	Low: shallow depth, corrosivity, low strength, shrink-swell.	Medium: shallow depth, too clayey, dusty.
Tobosa-Lipan	2	High: soil blowing, droughty.	Medium: soil blowing, droughty.	Medium: droughty.	Low: shrink-swell, low strength, corrosivity.	Low: too clayey, flooding.

TABLE 3.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AnA	Angelo silty clay loam, 0 to 1 percent slopes	68,370	11.7
AnB	Angelo silty clay loam, 1 to 3 percent slopes	81,270	13.9
BED	Berda soils, undulating	2,410	0.4
BrB	Broome silty clay loam, 1 to 3 percent slopes	35,330	6.0
CBD	Cobb association, undulating	280	([1])
Cd	Colorado soils, frequently flooded	1,360	0.2
CnB	Conger loam, 1 to 3 percent slopes	23,250	4.0
DR	Dev and Rioconcho soils	1,980	0.3
ECD	Ector association, undulating	143,140	24.5
ECG	Ector association, hilly	66,830	11.4
KOD	Kimbrough-Owens association, undulating	4,310	0.7
KSD	Kimbrough-Sharvana association, undulating	570	0.1
KTD	Kimbrough and Potter soils, undulating	48,760	8.3
Lc	Lipan clay, depressional	1,180	0.2
MeA	Mereta clay loam, 0 to 1 percent slopes	4,180	0.7
MeB	Mereta clay loam, 1 to 3 percent slopes	31,480	5.4
OtB	Olton clay loam, 1 to 3 percent slopes	2,710	0.5
ReA	Reagan silty clay loam, 0 to 1 percent slopes	2,630	0.5
ReB	Reagan silty clay loam, 1 to 3 percent slopes	4,720	0.8
Ro	Rioconcho silty clay loam	28,520	4.9
TAG	Tarrant-Rock outcrop association, hilly	20,800	3.6
ToA	Tobosa clay, 0 to 1 percent slopes	10,880	1.9
	Total	584,960	100.0

[1]Less than 0.1 percent.

TABLE 4.—CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass): Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	—	—	—	—	—
(I)	99,520	—	—	—	—
II (N)	28,520	—	—	—	28,520
(I)	121,320	121,320	—	—	—
III (N)	234,220	150,790	—	15,060	68,370
(I)	2,710	2,710	—	—	—
IV (N)	8,530	4,720	1,180	—	2,630
(I)	—	—	—	—	—
V (N)	1,360	—	1,360	—	—
VI (N)	27,920	25,940	1,980	—	—
VII (N)	284,410	—	—	284,410	—
VIII (N)	—	—	—	—	—

TABLE 5.—YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields are those to be expected under a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited. Soils on which crops are not commonly grown are not listed]

Soil name and map symbol	Cotton		Grain sorghum		Wheat		Oats		Alfalfa	
	N	I	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
Angelo:										
AnA	200	1,100	30	110	20	50	35	80	—	9
AnB	200	900	30	100	15	45	30	70	—	7
Broome:										
BrB	250	800	25	50	12	40	30	60	—	5
Lipan:										
Lc	250	—	20	—	15	—	—	—	—	—
Mereta:										
MeA	200	—	25	—	20	—	—	—	—	—
MeB	150	—	20	—	15	—	—	—	—	—
Olton:										
OtB	175	780	15	100	14	50	35	80	—	9
Reagan:										
ReA	—	1,250	20	90	12	40	—	60	—	6
ReB	—	1,000	15	75	10	35	—	60	—	6
Rioconcho:										
Ro	250	1,000	35	100	20	45	40	80	—	8
Tobosa:										
ToA	250	—	30	—	20	—	30	—	—	—

TABLE 6.—RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Angelo:					
AnA, AnB	Clay Loam	Favorable	3,500	Sideoats grama	30
		Normal	2,500	Buffalograss	20
		Unfavorable	1,500	Cane bluestem	10
				Vine-mesquite	10
				Tobosa	10
				Texas wintergrass	5
				Slim tridens	5
				Threeawn	5
				Other annual and perennial forbs	4
				Other shrubs	1
Berda:					
[1]BED	Sandy Loam	Favorable	2,500	Black grama	20
		Normal	1,850	Sideoats grama	15
		Unfavorable	1,200	Cane bluestem	10
				Reverchon panicum	10
				Slim tridens	5
				Hooded windmill	5
				Buffalograss	5
				Hairy grama	5
				Plains bristlegrass	5
				Threeawn	5
				Other perennial forbs	5
				Other shrubs	5
				Other perennial grasses	5
Broome:					
BrB	Loamy	Favorable	2,500	Buffalograss	20
		Normal	1,800	Sideoats grama	15
		Unfavorable	600	Tobosa	10
				Burrograss	10
				Threeawn	10
				Vine-mesquite	5
				Plains bristlegrass	5
				Cane bluestem	5
				Fall witchgrass	5
				Other perennial grasses	5
				Other annual and perennial forbs	5
				Other shrubs	5
Cobb:					
[1]CBD	Sandy Loam	Favorable	3,000	Black grama	20
		Normal	2,400	Sideoats grama	15
		Unfavorable	1,800	Cane bluestem	10
				Plains bristlegrass	5
				Hooded windmill	5
				Slim tridens	5
				Sand dropseed	5
				Buffalograss	5
				Reverchon panicum	5
				Threeawn	5
				Other perennial grasses	10
				Other shrubs	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Colorado:					
[1]Cd	Loamy Bottomland	Favorable	3,200	Sideoats grama	20
		Normal	2,500	Vine-mesquite	15
		Unfavorable	1,800	Cane bluestem	10
				Indiangrass	5
				Plains bristlegrass	5
				Canada wildrye	5
				Tobosa	5
				Texas wintergrass	5
				Switchgrass	5
				False switchgrass	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5
Conger:					
CnB	Shallow	Favorable	1,400	Black grama	15
		Normal	1,000	Sideoats grama	15
		Unfavorable	700	Buffalograss	15
				Slim tridens	10
				Reverchon panicum	5
				Arizona cottontop	5
				Plains bristlegrass	5
				Sand dropseed	5
				Burrograss	5
				Other perennial forbs	10
				Other perennial grasses	10
Dev:					
[1]DR:					
Dev part	Loamy Bottomland	Favorable	4,000	Sideoats grama	20
		Normal	3,000	Cane bluestem	15
		Unfavorable	1,000	Vine-mesquite	10
				Buffalograss	10
				Canada wildrye	5
				Arizona cottontop	5
				Plains bristlegrass	5
				Tobosa	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	4
				Other annual forbs	1
Rioconcho part	Loamy Bottomland	Favorable	4,000	Sideoats grama	20
		Normal	3,500	Vine-mesquite	15
		Unfavorable	2,500	Buffalograss	10
				Cane bluestem	10
				Canada wildrye	5
				Indiangrass	5
				Texas wintergrass	5
				Plains bristlegrass	5
				Switchgrass	5
				Other perennial grasses	10
				Other annual and perennial forbs	5
				Other trees	5
Ector:					
[1]ECD, [1]ECG	Limestone Hill	Favorable	1,600	Sideoats grama	25
		Normal	1,200	Slim tridens	15
		Unfavorable	800	Threeawn	10
				Hairy tridens	5
				Cane bluestem	5
				Fall witchgrass	5
				Green sprangletop	5
				Plains bristlegrass	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5

See footnote at end of table.

TABLE 6.—RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Kimbrough:					
[1]KOD:					
Kimbrough part	Very Shallow	Favorable	1,000	Sideoats grama	15
		Normal	750	Black grama	12
		Unfavorable	500	Reverchon panicum	10
				Threeawn	10
				Buffalograss	10
				Green sprangletop	10
				Sand dropseed	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other annual forbs	5
				Other shrubs	3
Owens part	Shallow Clay	Favorable	1,200	Buffalograss	30
		Normal	800	Sideoats grama	10
		Unfavorable	600	Arizona cottontop	10
				Vine-mesquite	10
				Texas wintergrass	5
				Hairy grama	5
				Slim tridens	5
				Threeawn	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
[1]KSD:					
Kimbrough part	Very Shallow	Favorable	1,000	Sideoats grama	15
		Normal	750	Black grama	12
		Unfavorable	500	Reverchon panicum	10
				Threeawn	10
				Buffalograss	10
				Green sprangletop	10
				Sand dropseed	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other annual forbs	5
				Other shrubs	3
Sharvana part	Sandy Loam	Favorable	2,000	Black grama	20
		Normal	1,550	Sideoats grama	15
		Unfavorable	1,000	Slim tridens	10
				Hooded windmill	10
				Plains bristlegrass	5
				Vine-mesquite	5
				Fall witchgrass	5
				Buffalograss	5
				Other perennial forbs	10
				Other perennial grasses	10
				Other shrubs	5
[1]KTD:					
Kimbrough part	Very Shallow	Favorable	1,000	Sideoats grama	15
		Normal	750	Black grama	12
		Unfavorable	500	Blue grama	10
				Threeawn	10
				Buffalograss	10
				Green sprangletop	10
				Sand dropseed	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other annual forbs	5
				Other shrubs	3

See footnote at end of table.

TABLE 6.—RANGELEND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Kimbrough:					
Potter part	Very Shallow	Favorable	900	Sideoats grama	15
		Normal	700	Black grama	15
		Unfavorable	400	Little bluestem	10
				Reverchon panicum	10
				Buffalograss	10
				Threeawn	10
				Hairy grama	5
				Other perennial grasses	10
				Other annual forbs	5
				Other perennial forbs	5
				Other shrubs	5
Lipan:					
Lc	Lakebed	Favorable	4,000	Buffalograss	25
		Normal	2,000	Vine-mesquite	25
		Unfavorable	500	White tridens	10
				Knotgrass	10
				Other perennial grasses	10
				Other annual forbs	10
				Other annual grasses	5
				Other perennial forbs	5
Mereta:					
MeA, MeB	Shallow	Favorable	2,000	Buffalograss	20
		Normal	1,400	Sideoats grama	15
		Unfavorable	1,000	Slim tridens	15
				Tobosa	10
				Threeawn	5
				Reverchon panicum	5
				Cane bluestem	5
				Green sprangletop	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other shrubs	5
Olton:					
OtB	Clay Loam	Favorable	3,500	Sideoats grama	30
		Normal	2,500	Buffalograss	20
		Unfavorable	1,500	Vine-mesquite	10
				Tobosa	10
				Cane bluestem	10
				Threeawn	5
				Other perennial grasses	10
				Other perennial forbs	3
				Other annual forbs	2
Reagan:					
ReA, ReB	Loamy	Favorable	2,200	Buffalograss	20
		Normal	1,550	Tobosa	15
		Unfavorable	700	Sideoats grama	15
				Burrograss	15
				Vine-mesquite	5
				Fall witchgrass	5
				Sand muhly	5
				Other perennial grasses	10
				Other shrubs	5
				Other annual and perennial forbs	5

See footnote at end of table.

TABLE 6.—RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Rioconcho:					
Ro	Loamy Bottomland	Favorable	4,000	Sideoats grama	20
		Normal	3,500	Buffalograss	10
		Unfavorable	2,500	Silver bluestem	10
				Canada wildrye	10
				Vine-mesquite	10
				Indiangrass	5
				Texas wintergrass	5
				Plains bristlegrass	5
				Switchgrass	5
				Other perennial grasses	10
				Other annual forbs	5
				Other trees	5
Tarrant:					
[1]TAG:					
Tarrant part	Low Stony Hill	Favorable	2,500	Sideoats grama	25
		Normal	1,400	Cane bluestem	10
		Unfavorable	1,000	Green sprangletop	10
				Little bluestem	5
				Hairy grama	5
				Threeawn	5
				Slim tridens	5
				Fall witchgrass	5
				Live oak and shin oak	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5
Rock outcrop part.					
Tobosa:					
ToA	Clay Flat	Favorable	3,000	Tobosa	35
		Normal	2,300	Buffalograss	20
		Unfavorable	1,000	Sideoats grama	10
				Vine-mesquite	10
				Cane bluestem	5
				Texas wintergrass	5
				Threeawn	5
				Other annual forbs and grasses	5
				Other perennial grasses	5

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 7.—BUILDING SITE DEVELOPMENT

["Shrink-swell," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe". Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Angelo:					
AnA, AnB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Berda:					
[1]BED	Slight	Slight	Slight	Moderate: slope.	Slight.
Broome:					
BrB	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Cobb:					
[1]CBD	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Colorado:					
[1]Cd	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Conger:					
CnB	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.
Dev:					
[1]DR:					
Dev part	Severe: floods, small stones.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Rioconcho part	Severe: floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Ector:					
[1]ECD	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
[1]ECG	Severe: slope, depth to rock, small stones.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Kimbrough:					
[1]KOD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Owens part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
[1]KSD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Sharvana part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
[1]KTD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.

See footnote at end of table.

TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Kimbrough:					
Potter part	Moderate: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Lipan:					
Lc	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Mereta:					
MeA, MeB	Moderate: cemented pan.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.	Moderate: cemented pan, shrink-swell.
Olton:					
OtB	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Reagan:					
ReA, ReB	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Rioconcho:					
Ro	Severe: floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Tarrant:					
[1]TAG	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Tobosa:					
ToA	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.—SANITARY FACILITIES

["Percs slowly," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "good." Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Angelo:					
AnA, AnB	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair.
Berda:					
[1]BED	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Broome:					
BrB	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Cobb:					
[1]CBD	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
Colorado:					
[1]Cd	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Conger:					
CnB	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Dev:					
[1]DR:					
Dev part	Severe: floods.	Severe: floods, seepage, small stones.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: small stones.
Rioconcho part	Severe: percs slowly, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Ector:					
[1]ECD	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
[1]ECG	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, small stones.
Kimbrough:					
[1]KOD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Owens part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, area reclaim.
[1]KSD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Sharvana part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Kimbrough:					
[1]KTD:					
Kimbrough part	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Potter part	Severe: seepage.	Moderate: seepage.	Moderate: small stones.	Slight	Poor: thin layer.
Lipan:					
Lc	Severe: floods, percs slowly.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Mereta:					
MeA, MeB	Severe: cemented pan, percs slowly.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Olton:					
OtB	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Reagan:					
ReA, ReB	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Rioconcho:					
Ro	Severe: percs slowly, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Tarrant:					
[1]TAG	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: thin layer, large stones, too clayey.
Tobosa:					
ToA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.--CONSTRUCTION MATERIALS

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Angelo:				
AnA, AnB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Berda:				
[1]BED	Fair: low strength.	Unsuited	Unsuited	Good.
Broome:				
BrB	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: excess lime, too clayey.
Cobb:				
[1]CBD	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
Colorado:				
[1]Cd	Fair: low strength.	Unsuited	Unsuited	Good.
Conger:				
CnB	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
Dev:				
[1]DR:				
Dev part	Good	Unsuited	Poor: excess fines.	Poor: small stones.
Rioconcho part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Ector:				
[1]ECD, [1]ECG	Poor: thin layer.	Unsuited	Unsuited	Poor: thin layer, small stones.
Kimbrough:				
[1]KOD:				
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.
Owens part	Poor: shrink-swell.	Unsuited	Unsuited	Poor: too clayey.
[1]KSD:				
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.
Sharvana part	Poor: thin layer.	Unsuited	Unsuited	Fair: thin layer.
[1]KTD:				
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Poor: area reclaim, excess lime, small stones.

See footnote at end of table.

TABLE 9.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Kimbrough: Potter part	Good	Unsuited	Unsuited	Poor: thin layer, small stones.
Lipan: Lc	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Mereta: MeA, MeB	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Poor: area reclaim.
Olton: OtB	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
Reagan: ReA, ReB	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey, excess lime.
Rioconcho: Ro	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Tarrant: [1]TAG	Poor: thin layer, large stones.	Unsuited	Unsuited	Poor: thin layer, large stones.
Tobosa: ToA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.—WATER MANAGEMENT

["Seepage," "slope," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for— Pond reservoir areas	Limitations for— Embankments, dikes, and levees	Features affecting— Irrigation	Features affecting— Terraces and diversions	Features affecting— Grassed waterways
Angelo:					
AnA, AnB	Moderate: seepage.	Moderate: compressible.	Slow intake	Favorable	Favorable.
Berda:					
[1]BED	Moderate: seepage.	Moderate: piping, erodes easily.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Broome:					
BrB	Moderate: seepage.	Moderate: compressible, piping.	Droughty, excess lime.	Favorable	Favorable.
Cobb:					
[1]CBD	Severe: depth to rock.	Moderate: thin layer.	Erodes easily, rooting depth.	Depth to rock	Rooting depth.
Colorado:					
[1]Cd	Moderate: seepage.	Moderate: compressible, piping.	Seepage, floods.	Floods	Favorable.
Conger:					
CnB	Severe: cemented pan, seepage.	Severe: thin layer, seepage.	Rooting depth, droughty.	Cemented pan	Rooting depth, droughty.
Dev:					
[1]DR:					
Dev part	Severe: seepage.	Severe: seepage.	Floods, seepage, droughty.	Piping, floods.	Droughty.
Rioconcho part	Moderate: seepage.	Moderate: compressible, piping.	Floods, slow intake.	Percs slowly	Percs slowly.
Ector:					
[1]ECD, [1]ECG	Severe: depth to rock.	Severe: thin layer.	Rooting depth	Depth to rock	Rooting depth.
Kimbrough:					
[1]KOD:					
Kimbrough part	Severe: cemented pan.	Severe: thin layer.	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.	Droughty, rooting depth.
Owens part	Slight	Moderate: compressible.	Droughty, percs slowly.	Rooting depth, percs slowly.	Droughty, erodes easily.
[1]KSD:					
Kimbrough part	Severe: cemented pan.	Severe: thin layer.	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.	Droughty, rooting depth.
Sharvana part	Severe: cemented pan.	Severe: thin layer.	Rooting depth, droughty.	Cemented pan, rooting depth.	Rooting depth, droughty.
[1]KTD:					
Kimbrough part	Severe: cemented pan.	Severe: thin layer.	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.	Droughty, rooting depth.

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

Soil name and map symbol	Limitations for— Pond reservoir areas	Embankments, dikes, and levees	Features affecting— Irrigation	Terraces and diversions	Grassed waterways
Kimbrough:					
Potter part	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Lipan:					
Lc	Slight	Moderate: compressible, unstable fill.	Floods, slow intake.	Percs slowly	Percs slowly.
Mereta:					
MeA, MeB	Severe: cemented pan.	Severe: thin layer.	Rooting depth	Cemented pan, rooting depth.	Rooting depth, droughty.
Olton:					
OtB	Moderate: seepage.	Moderate: piping.	Slow intake	Favorable	Favorable.
Reagan:					
ReA, ReB	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable.
Rioconcho:					
Ro	Moderate: seepage.	Moderate: compressible, piping.	Floods, slow intake.	Percs slowly	Percs slowly.
Tarrant:					
[1]TAG	Severe: depth to rock.	Severe: thin layer, large stones.	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
Tobosa:					
ToA	Slight	Moderate: compressible, unstable fill.	Slow intake	Percs slowly	Percs slowly.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 11.—RECREATIONAL DEVELOPMENT

["Percs slowly," "floods," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Angelo:				
AnA, AnB	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Berda:				
[1]BED	Slight	Slight	Moderate: slope.	Slight.
Broome:				
BrB	Moderate: dusty, too clayey.	Moderate: dusty, too clayey.	Moderate: dusty, too clayey, slope.	Moderate: dusty, too clayey.
Cobb:				
[1]CBD	Slight	Slight	Moderate: depth to rock.	Slight.
Colorado:				
[1]Cd	Severe: floods.	Moderate: dusty, floods.	Moderate: dusty, floods.	Slight.
Conger:				
CnB	Moderate: dusty.	Moderate: dusty.	Severe: depth to rock.	Moderate: dusty.
Dev:				
[1]DR:				
Dev part	Severe: floods, small stones.	Severe: small stones.	Severe: floods, small stones.	Severe: small stones.
Rioconcho part	Moderate: percs slowly, floods, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey, floods.	Moderate: too clayey.
Ector:				
[1]ECD	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, slope.	Moderate: slope, small stones.
[1]ECG	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: slope, small stones.
Kimbrough:				
[1]KOD:				
Kimbrough part	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
Owens part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
[1]KSD:				
Kimbrough part	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
Sharvana part	Slight	Slight	Severe: depth to rock.	Slight.

See footnote at end of table.

TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Kimbrough:				
[1]KTD:				
Kimbrough part	Moderate: small stones.	Moderate: small stones.	Severe: small stones, cemented pan.	Moderate: small stones.
Potter part	Slight	Slight	Moderate: slope, small stones.	Slight.
Lipan:				
Lc	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.
Mereta:				
MeA, MeB	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: cemented pan.	Moderate: too clayey.
Olton:				
OtB	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
Reagan:				
ReA	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.
ReB	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: slope, dusty.	Moderate: too clayey, dusty.
Rioconcho:				
Ro	Moderate: percs slowly, floods, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey, floods.	Moderate: too clayey.
Tarrant:				
[1]TAG	Severe: large stones, slope.	Severe: large stones, too clayey.	Severe: depth to rock, slope.	Severe: large stones, slope.
Tobosa:				
ToA	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements--				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Angelo:						
AnA, AnB	Fair	Fair	Fair	Fair	Fair	Fair.
Berda:						
[1]BED	Fair	Fair	Fair	Fair	Fair	Fair.
Broome:						
BrB	Fair	Fair	Fair	Fair	Fair	Fair.
Cobb:						
[1]CBD	Fair	Good	Good	Good	Good	Good.
Colorado:						
[1]Cd	Very poor.	Poor	Fair	Good	Poor	Fair.
Conger:						
CnB	Poor	Poor	Fair	Fair	Poor	Fair.
Dev:						
[1]DR:						
Dev part	Poor	Poor	Fair	Fair	Poor	Fair.
Rioconcho part	Good	Good	Fair	Good	Good	Fair.
Ector:						
[1]ECD, [1]ECG	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Kimbrough:						
[1]KOD:						
Kimbrough part	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Owens part	Poor	Fair	Fair	Poor	Fair	Poor.
[1]KSD:						
Kimbrough part	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Sharvana part	Poor	Poor	Fair	Fair	Poor	Fair.
[1]KTD:						
Kimbrough part	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Potter part	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Lipan:						
Lc	Fair	Fair	Fair	Very poor.	Fair	Poor.
Mereta:						
MeA, MeB	Fair	Fair	Fair	Fair	Fair	Fair.
Olton:						
OtB	Fair	Fair	Fair	Fair	Fair	Fair.
Reagan:						
ReA, ReB	Fair	Good	Fair	Fair	Fair	Fair.
Rioconcho:						
Ro	Good	Good	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 12.—WILDLIFE HABITAT POTENTIALS—Continued

Soil name and map symbol	Potential for habitat elements—				Potential as habitat for—	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Tarrant: [1]TAG	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Tobosa: ToA	Fair	Fair	Poor	Fair	Fair	Poor.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Angelo:											
AnA, AnB	0-14	Silty clay loam	CL	A-6, A-7-6	0	90-100	90-100	85-100	60-90	37-50	16-27
	14-29	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7-6	0	90-100	90-100	85-100	70-92	39-60	18-35
	29-80	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7-6	0	60-100	60-100	60-100	50-90	35-55	12-30
Berda:											
[1]BED	0-10	Loam	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	10-80	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
Broome:											
BrB	0-7	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	85-100	85-100	36-44	17-25
	7-39	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	85-100	80-100	70-98	38-49	19-28
	39-80	Clay loam, silty clay loam.	CL	A-6	0	95-100	90-100	85-100	80-100	31-40	13-20
Cobb:											
[1]CBD	0-6	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	90-100	90-100	75-90	30-50	17-25	3-7
	6-26	Sandy clay loam	SC, CL, SM-SC, CL-ML	A-6, A-4	0	90-100	85-100	80-98	40-60	20-40	7-20
	26-40	Unweathered bedrock.									
Colorado:											
[1]Cd	0-80	Loam	CL, ML	A-4, A-6, A-7-6	0-2	75-100	75-100	60-100	55-95	29-43	10-21
Conger:											
CnB	0-14	Loam	CL, CL-ML	A-4, A-6	0-5	75-95	70-95	65-90	51-75	20-40	5-20
	14-24	Indurated									
	24-80	Variable									
Dev:											
[1]DR:											
Dev part	0-80	Very gravelly loam.	GC, GP-GC	A-2-4, A-2-6	0-10	10-53	5-50	5-45	5-35	28-40	9-20
Rioconcho part	0-80	Silty clay loam, silty clay.	CL, CH	A-6, A-7-6	0-10	85-100	83-100	75-100	70-97	39-62	20-38
Ector:											
[1]ECD, [1]ECG	0-17	Very gravelly loam.	GC, SC, GM	A-2-4, A-2-6, A-7-5	5-45	30-70	20-65	15-50	13-40	25-35	8-15
	17-80	Unweathered bedrock.									
Kimbrough:											
[1]KOD:											
Kimbrough part	0-9	Gravelly loam	GM, ML, CL-ML	A-2, A-4	0-10	55-80	50-75	40-70	30-55	<30	[2]NP-7
	9-24	Indurated									
Owens part	0-5	Clay	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
	5-15	Clay, clay loam	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	15-80	Shaly clay	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	55-95	40-55	25-35

See footnotes at end of table.

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Kimbrough:											
[1]KSD:											
Kimbrough part	0-9	Gravelly loam	GM, ML, CL-ML	A-2, A-4	0-10	55-80	50-75	40-70	30-55	<30	NP-7
	9-24	Indurated									
Sharvana part	0-5	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	100	70-95	30-50	17-25	2-7
	5-18	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	70-95	36-60	20-35	5-18
	18-30	Indurated									
[1]KTD:											
Kimbrough part	0-9	Gravelly loam	GM, ML, CL-ML	A-2, A-4	0-10	55-80	50-75	40-70	30-55	<30	NP-7
	9-24	Indurated									
Potter part	0-7	Gravelly loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	7-80	Variable	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Lipan:											
Lc	0-60	Clay	CH	A-7-6	0-15	85-100	80-100	80-100	80-95	55-75	32-49
	60-80	Clay, silty clay	CH	A-7-6	0-15	85-100	80-100	80-100	70-95	46-66	25-40
Mereta:											
MeA, MeB	0-15	Clay loam	CL, CH	A-6, A-7-6	0-5	90-100	83-100	80-97	60-85	39-52	19-30
	15-24	Variable, cemented.									
	24-78	Variable, marl.									
Olton:											
OtB	0-7	Clay loam	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	7-32	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	32-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
Reagan:											
ReA, ReB	0-34	Silty clay loam	CL	A-6, A-7-6	0	95-100	95-100	90-100	70-95	35-45	18-28
	34-80	Silty clay, silty clay loam, loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	65-95	35-50	18-30
Rioconcho:											
Ro	0-80	Silty clay loam, silty clay.	CL, CH	A-6, A-7-6	0-10	85-100	83-100	75-100	70-97	39-62	20-38
Tarrant:											
[1]TAG	0-12	Cobbly clay	CH, GC, GM	A-7-6, A-7-5	33-77	55-100	51-100	48-95	36-95	55-76	31-49
	12-20	Indurated, unweathered bedrock.									
Tobosa:											
ToA	0-60	Clay	CH	A-7-6	0-5	80-100	75-100	75-100	75-98	51-72	30-45
	60-80	Clay, silty clay	CH, CL	A-7-6	0-5	80-100	75-100	75-100	70-95	45-65	25-40

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.
[2]NP means nonplastic.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Angelo:										
AnA, AnB	0-14	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.32	4	6
	14-29	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
	29-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.32		
Berda:										
[1]BED	0-10	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.28	5	5
	10-80	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.32		
Broome:										
BrB	0-7	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low	0.37	5	6
	7-39	0.6-2.0	0.10-0.15	7.9-8.4	Moderate	Moderate	Low	0.37		
	39-80	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	Moderate	Low	0.49		
Cobb:										
[1]CBD	0-6	2.0-6.0	0.10-0.15	6.1-7.3	Low	Low	Low	0.24	3	3
	6-26	0.6-2.0	0.12-0.16	6.1-8.4	Low	Moderate	Low	0.32		
	26-40									
Colorado:										
[1]Cd	0-80	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.32	5	5
Conger:										
CnB	0-14	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.28	1	4L
	14-24									
	24-80									
Dev:										
[1]DR:										
Dev part	0-80	2.0-6.0	0.03-0.10	7.9-8.4	Very low	Moderate	Low	0.10	5	8
Rioconcho part	0-80	0.06-0.2	0.15-0.20	7.4-8.4	High	High	Low	0.32	5	7
Ector:										
[1]ECD, [1]ECG	0-17	0.6-2.0	0.05-0.12	7.9-8.4	Very low	High	Low	0.28	1	8
	17-80									
Kimbrough:										
[1]KOD:										
Kimbrough part	0-9	0.6-2.0	0.11-0.15	7.4-8.4	Low	Moderate	Low	0.28	1	8
	9-24									
Owens part	0-5	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37	1	8
	5-15	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37		
	15-80	<0.06	0.03-0.08	7.9-8.4	High	High	Low	0.37		
[1]KSD:										
Kimbrough part	0-9	0.6-2.0	0.11-0.15	7.4-8.4	Low	Moderate	Low	0.28	1	8
	9-24									
Sharvana part	0-5	2.0-6.0	0.11-0.15	6.6-8.4	Low	Low	Low	0.24	1	3
	5-18	0.6-2.0	0.12-0.17	7.4-8.4	Low	Moderate	Low	0.32		
	18-30									
[1]KTD:										
Kimbrough part	0-9	0.6-2.0	0.11-0.15	7.4-8.4	Low	Moderate	Low	0.28	1	8
	9-24									
Potter part	0-7	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.28	1	8
	7-80	0.6-6.0	0.00-0.06	7.9-8.4	Low	Moderate	Low	0.28		
Lipan:										
Lc	0-60	<0.06	0.13-0.18	7.4-8.4	Very high	High	Low	0.32	5	4
	60-80	<0.06	0.13-0.18	7.9-8.4	Very high	High	Low	0.32		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Mereta:										
MeA, MeB	0-15	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	2	6
	15-24									
	24-78									
Olton:										
OtB	0-7	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low	0.32	5	6
	7-32	0.2-0.6	0.14-0.19	7.4-8.4	Moderate	Moderate	Low	0.37		
	32-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate	Moderate	Low	0.37		
Reagan:										
ReA, ReB	0-34	0.6-2.0	0.15-0.20	7.9-8.4	Moderate	Moderate	Low	0.32	5	4L
	34-80	0.6-2.0	0.10-0.16	7.9-8.4	Moderate	Moderate	Low	0.32		
Rioconcho:										
Ro	0-80	0.06-0.2	0.15-0.20	7.4-8.4	High	High	Low	0.32	5	7
Tarrant:										
[1]TAG	0-12	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	12-20									
Tobosa:										
ToA	0-60	<0.06	0.12-0.18	7.4-8.4	Very high	High	Low	0.32	4	4
	60-80	<0.06	0.10-0.18	7.9-8.4	Very high	High	Low	0.32		

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See Glossary under "Flooding" for descriptions of symbols and such terms as "rare," and "brief." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
Angelo:								
AnA, AnB	C	None	---	---	>60	---	---	---
Berda:								
[1]BED	B	None	---	---	>60	---	---	---
Broome:								
BrB	B	None	---	---	>60	---	---	---
Cobb:								
[1]CBD	B	None	---	---	20-40	Rippable	---	---
Colorado:								
[1]Cd	B	Rare to common.	Brief	May-Sep	>60	---	---	---
Conger:								
CnB	C	None	---	---	>60	---	12-20	Rippable.
Dev:								
[1]DR:								
Dev part	A	Frequent	Brief	Apr-Jun	>60	---	---	---
Rioconcho part	C	Rare to common.	Very brief to brief.	Apr-Jun	>60	---	---	---
Ector:								
[1]ECD, [1]ECG	D	None	---	---	4-20	Hard	---	---
Kimbrough:								
[1]KOD:								
Kimbrough part	D	None	---	---	>60	---	4-20	Hard.
Owens part	D	None	---	---	10-20	Rippable	---	---
[1]KSD:								
Kimbrough part	D	None	---	---	>60	---	4-20	Hard.
Sharvana part	C	None	---	---	>60	---	8-20	Rippable.
[1]KTD:								
Kimbrough part	D	None	---	---	>60	---	4-20	Hard.
Potter part	C	None	---	---	>60	---	---	---
Lipan:								
Lc	D	Rare to common.	Long to very long.	Apr-Jun	>60	---	---	---
Mereta:								
MeA, MeB	C	None	---	---	>60	---	14-20	Rippable.
Olton:								
OtB	C	None	---	---	>60	---	---	---
Reagan:								
ReA, ReB	B	None	---	---	>60	---	---	---
Rioconcho:								
Ro	C	Rare to common.	Very brief to brief.	Apr-Jun	>60	---	---	---

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness
					In		In	
Tarrant:								
[1]TAG	D	None	---	---	6-20	Hard	---	---
Tobosa:								
ToA	D	None	---	---	>60	---	---	---

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 16.—ENGINEERING TEST DATA

[Tests performed by the Texas Highway Department]

Soil name and location	Report number	Depth	Shrinkage: Limit	Shrinkage: Linear	Shrinkage: Ratio	Mechanical analysis[1] — Percentage passing sieve—: No. 4	No. 10	No. 40	No. 200	Percentage smaller than—: 0.05 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification[2]: AASHTO[3]	Unified[4]
		In	Pct	Pct									Pct			
Angelo silty clay loam:																
From the Sterling County Courthouse, east on U.S. Highway 87 for 0.7 mile, north along Texas Highway 158 for 0.7 mile, west for 0.3 mile, north 0.15 mile into F. E. Davis Ranch, in native pasture.	72-42R	0-8	15	12.6	1.86	98	96	94	84	68	30	18	41	22	A-7-6(13)	CL
	72-43R	14-29	14	13.3	1.92	95	93	92	83	—	—	—	42	23	A-7-6(14)	CL
	72-44R	44-58	17	6.2	1.82	78	72	68	59	54	37	27	28	12	A-6(6)	CL
Broome silty clay loam:																
From the Sterling County Courthouse, west along U.S. Highway 87 for 1.1 miles, south to boundary fence, 85 feet south of the boundary fence in native pasture on Jim Davis Ranch.	72-39R	6-23	15	12.4	1.88	100	100	100	94	81	41	31	40	23	A-6(13)	CL
	72-40R	23-64	13	12.8	1.96	100	99	99	96	—	—	—	40	25	A-6(14)	CL
	72-41R	64-90	15	9.7	1.91	100	100	100	98	87	37	30	33	19	A-6(12)	CL
Reagan silty clay loam:																
From the Sterling County Courthouse, west along U.S. Highway 87 for 15.8 miles, south through cattle guard along ranch road for 1.45 miles, 170 feet west in native pasture on McDonald-Steward Ranch.	72-46R	2-12	16	12.2	1.86	99	98	97	91	78	33	22	41	22	A-7-6(13)	CL
	72-47R	12-32	15	13.7	1.88	99	98	97	93	—	—	—	45	26	A-7-6(15)	CL
	72-48R	66-96	14	12.6	1.91	99	98	96	92	85	55	42	40	25	A-6(14)	CL
Tarrant very gravelly clay:																
From the Sterling County Courthouse, east on U.S. Highway 87 for 0.7 mile, north along Texas Highway 158 for 5.4 miles, 350 feet south in native pasture on F. E. Davis Ranch.	72-45R	0-8	15	20.2	1.78	56	51	49	38	—	—	—	69	35	A-7-5(6)	GM

[1]Mechanical analyses according to the AASHTO Designation T 88 (1). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2]Unified and AASHTO classifications made by SCS personnel.

[3]Based on AASHTO Designation M 145-49 (1).

[4]Based on the Unified soil classification system (2).

TABLE 17.—CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Angelo	Fine, mixed, thermic Torrertic Calciustolls
Berda	Fine-loamy, mixed, thermic Aridic Ustochrepts
Broome	Fine-silty, mixed, thermic Calciorthidic Paleustalfs
*Cobb	Fine-loamy, mixed, thermic Udic Haplustalfs
Colorado	Fine-loamy, mixed (calcareous), thermic Typic Ustifluvents
Conger	Loamy, mixed, thermic, shallow Ustollic Paleorthids
Dev	Loamy-skeletal, carbonatic, thermic Cumulic Haplustolls
Ector	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Kimbrough	Loamy, mixed, thermic, shallow Petrocalcic Calciustolls
Lipan	Fine, montmorillonitic, thermic Entic Pellusterts
Mereta	Clayey, mixed, thermic, shallow Petrocalcic Calciustolls
Olton	Fine, mixed, thermic Aridic Paleustolls
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
Reagan	Fine-silty, mixed, thermic Ustollic Calciorthids
Rioconcho	Fine, mixed, thermic Vertic Haplustolls
Sharvana	Loamy, mixed, thermic, shallow Petrocalcic Ustalfic Paleargids
Tarrant	Clayey-skeletal, montmorillonitic, thermic Lithic Calciustolls
Tobosa	Fine, montmorillonitic, thermic Typic Chromusterts

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