SOIL SURVEY OF

Blanco and Burnet Counties, Texas

United States Department of Agriculture

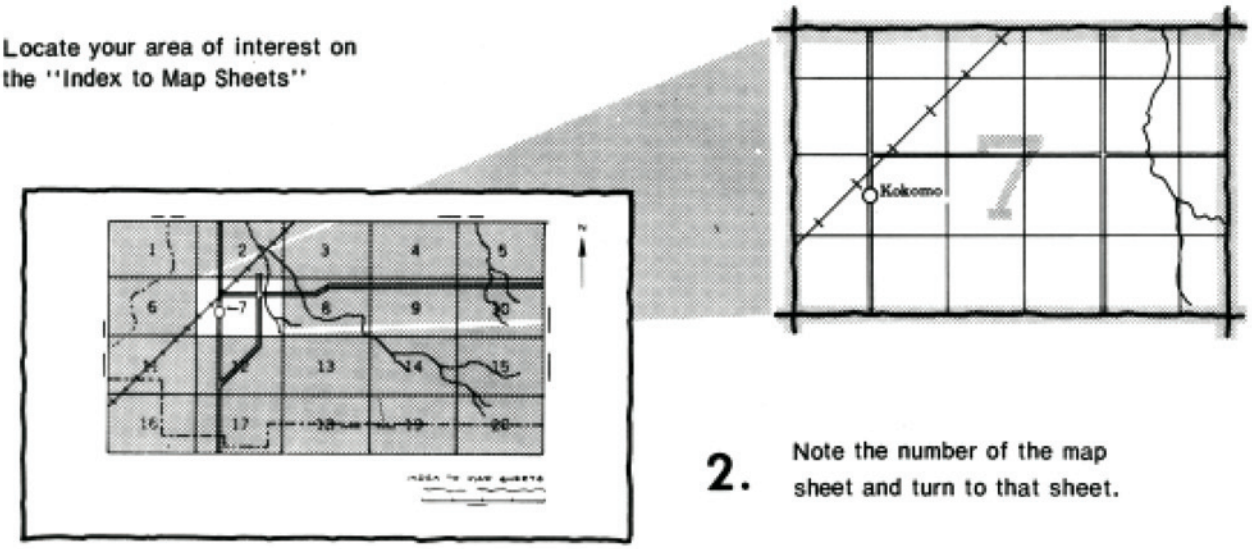
Soil Conservation Service

in cooperation with

Texas Agricultural Experiment Station

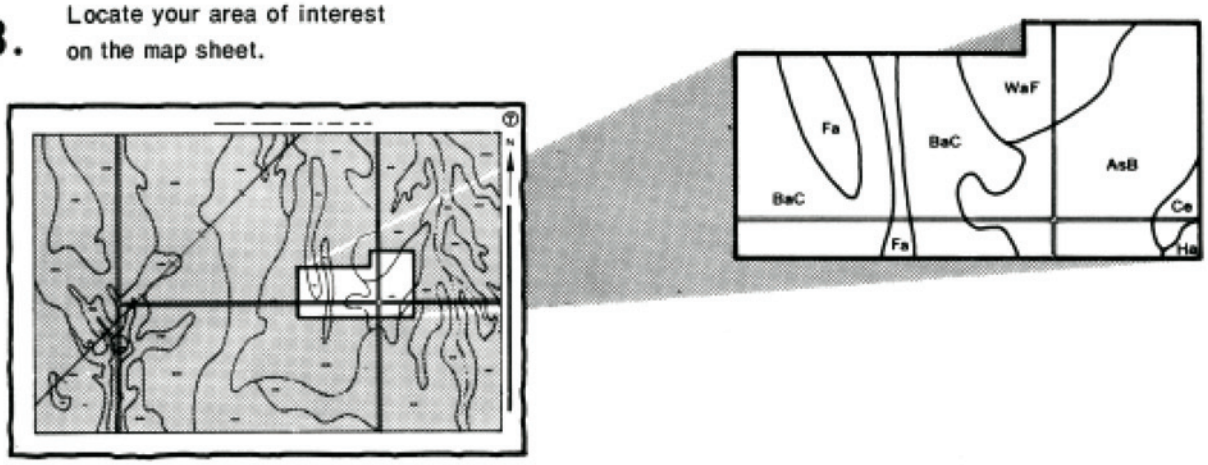
HOW TO USE

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

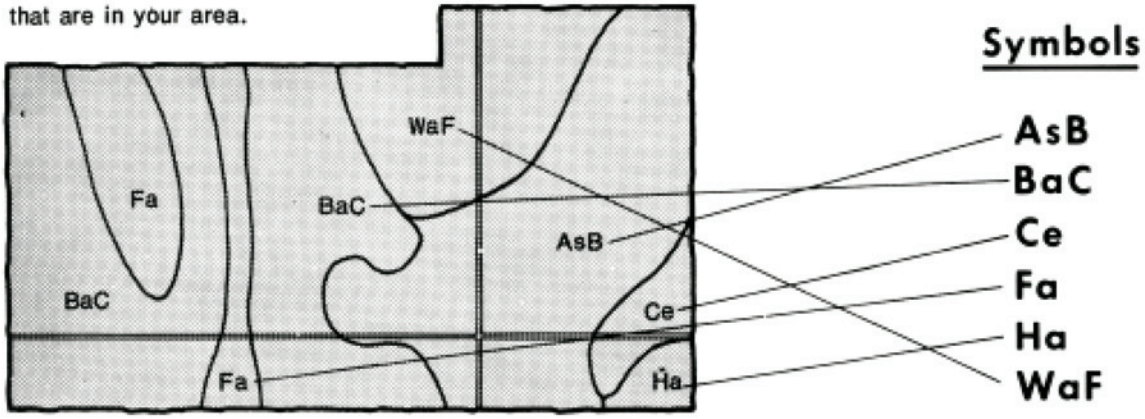


2. Note the number of the map sheet and turn to that sheet.

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

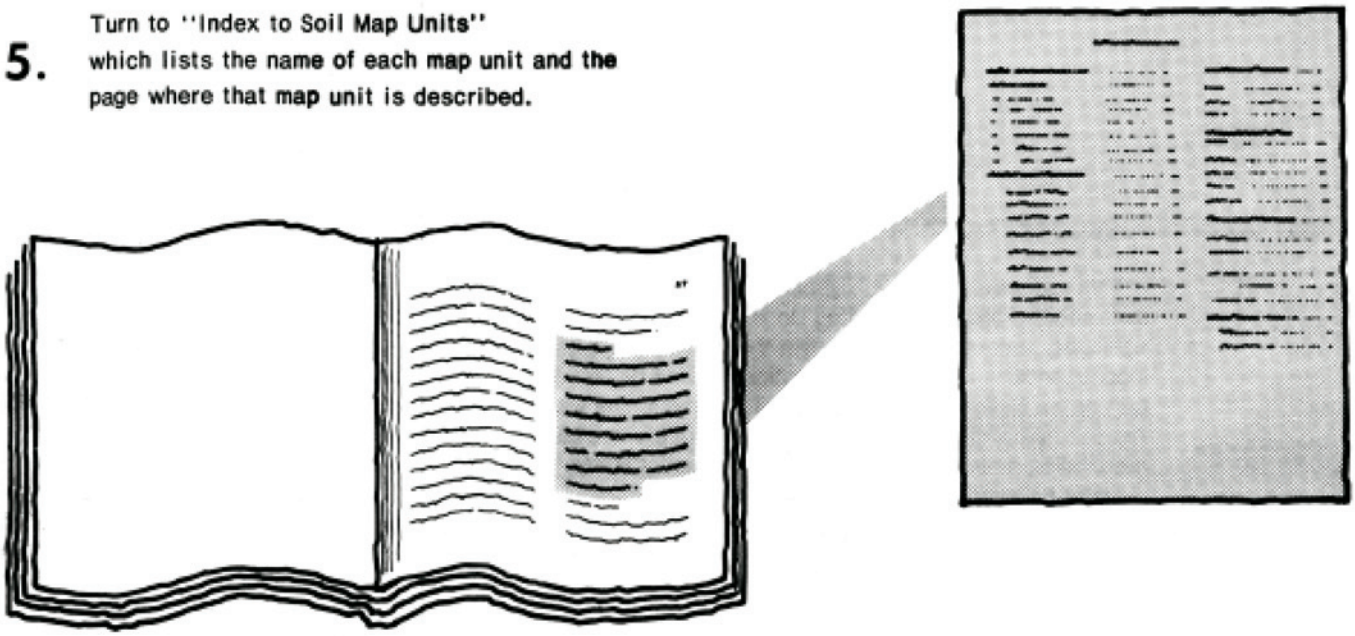


4. List the map unit symbols that are in your area.

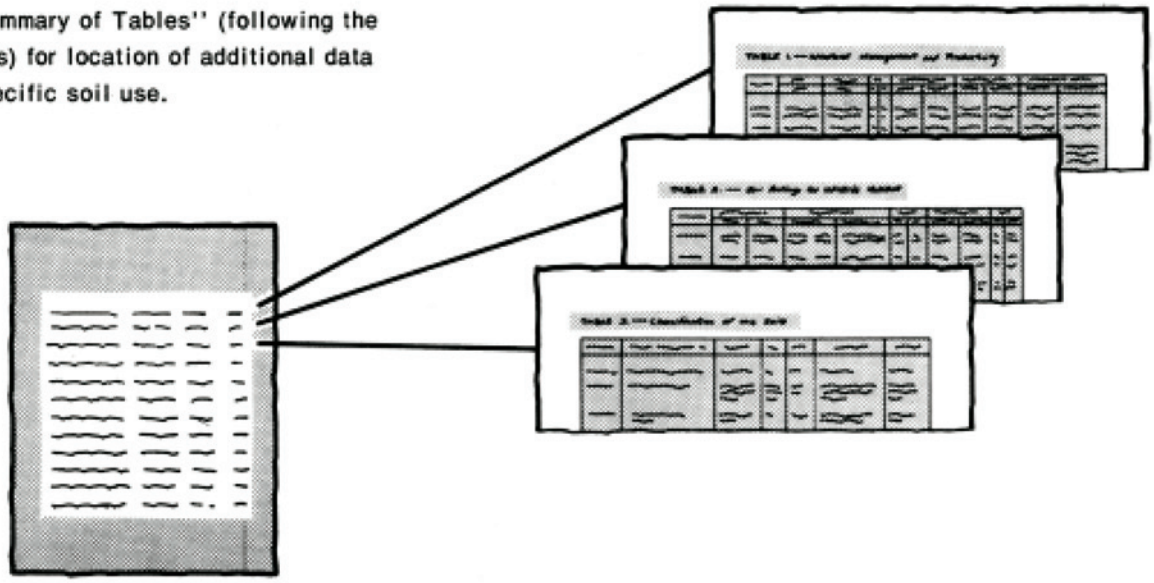


THIS SOIL SURVEY

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



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



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

This 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 1970-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. 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 Hill Country and Pedernales Soil and Water Conservation Districts.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can 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.

Cover: Cattle grazing on improved pasture. The soil is Lewisville clay loam, 0 to 1 percent slopes.

Contents

Issued August 1979

Index to soil map units

Summary of tables

Summary of tables—Continued

Foreword

The Soil Survey of Blanco and Burnet Counties 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.

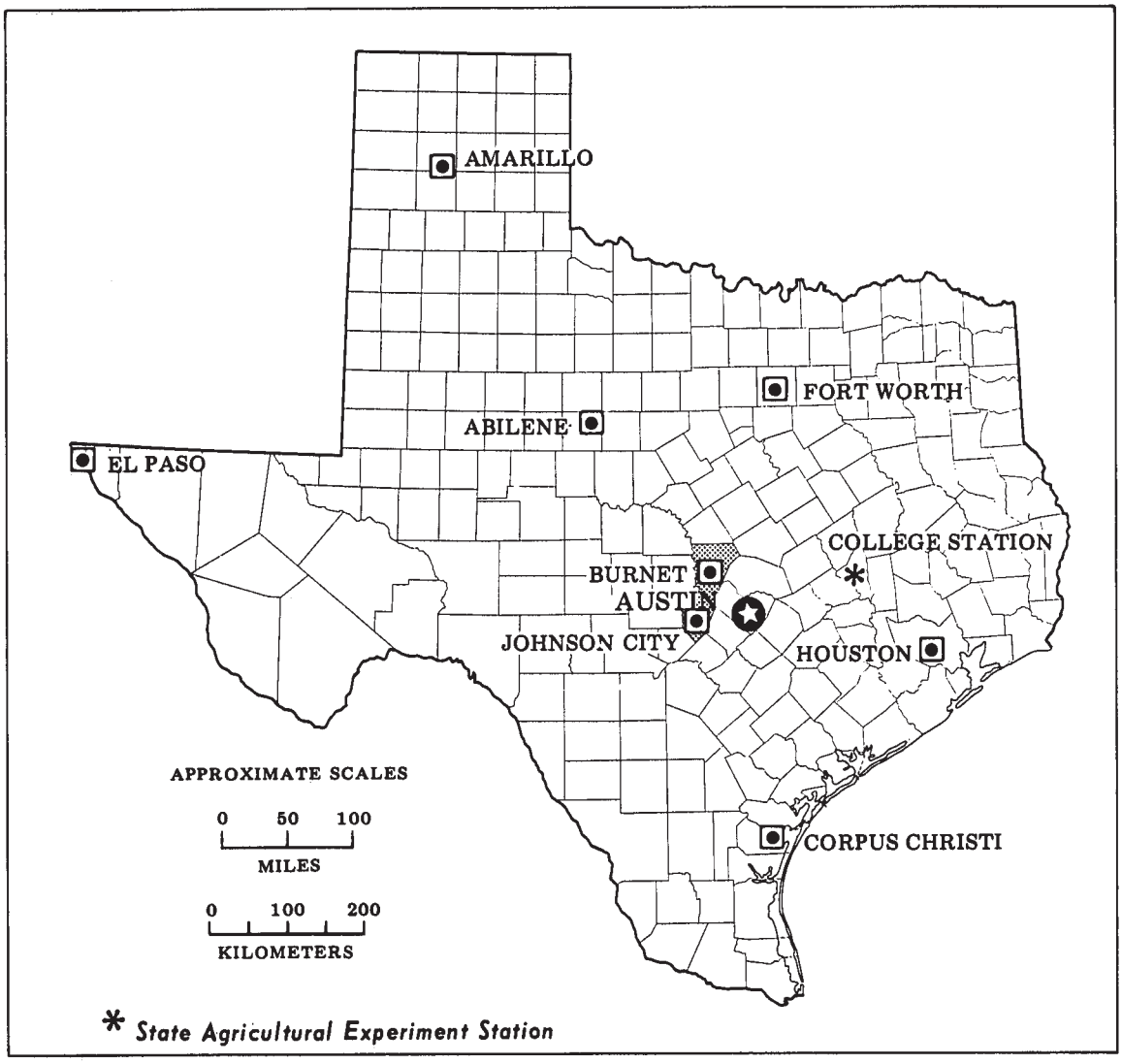
This soil survey has been prepared for many different users. Farmers, ranchers, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use 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.

Great differences in soil properties can occur even within short distances. Soils may be 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 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.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Blanco and Burnet Counties in Texas.

SOIL SURVEY OF BLANCO AND BURNET COUNTIES, TEXAS

By William H. Dittemore, Jr. and John E. Allison,
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United States Department of Agriculture, Soil Conservation Service,
in cooperation with Texas Agricultural Experiment Station

BLANCO AND BURNET COUNTIES are in the south-central part of Texas. Johnson City, the county seat of Blanco County, is about 65 miles north of San Antonio. Burnet, the county seat of Burnet County, is about 55 miles northwest of Austin.

Both counties are irregular in shape. The distance across both counties is about 75 miles from north to south, and 24 to 36 miles from west to east.

The total area of the counties is 1,741 square miles, or 1,114,240 acres, of which 16,960 acres is inland water. The Blanco, Little Blanco, Colorado, Lampasas, Pedernales, and San Gabriel Rivers are the major streams.

Approximately 999,770 acres in the counties is in range, 68,674 acres in cultivated crops, 3,525 acres in tame pasture crops, and 20,532 acres is used for urban purposes. Burnet, Johnson City, Blanco, Bertram, and Marble Falls are the principal towns. Other communities are Round Mountain, Sandy, Cypress Mill, Hye, Lake Victor, Briggs, Kingsland, and Granite Shoals.

Blanco and Burnet Counties are in the eastern part of the Edwards Plateau and the southern part of the Grand Prairie Land Resource Areas. The Texas Central Basin Land Resource Area extends into the northwestern and western part of the area. The Edwards Plateau makes up approximately 484,110 acres or 43.5 percent of the counties; the Grand Prairie, approximately 480,320 acres or 43.1 percent; the Central Basin, approximately 132,850 acres or 11.9 percent; and inland water, approximately 16,960 acres or 1.5 percent.

General nature of the county

The history, industry, transportation, natural resources, and climate of the area are described in this section.

History

The first permanent settlements in Blanco and Burnet Counties were made in the early 1850's. Settlers were attracted to the area by the many springs and streams and by favorable land for sheep and cattle raising.

Blanco County was formed and organized in 1858. It was named for the Blanco (white) River. Burnet County was formed in 1852 and was organized in 1854. It was named for David G. Burnet, provisional president of the Republic of Texas.

After a railroad was completed from Austin to Burnet in 1882, Burnet became the trade center for a large area to the west and north. A spur was extended 16 miles from Burnet to Granite Mountain in 1885, and granite was quarried and shipped to Austin for construction of the State capitol.

Industry

The major livestock products are beef cattle, sheep, and goats. Many ranchers also engage in commercial leasing of their ranches for deer hunting. There are a few dairy farms. The main crops are grain sorghum, small grain, and improved pasture. Peaches and pecans are grown commercially on a limited scale. In farming and ranching, brush control, range seeding, control of erosion, deferred grazing, providing water for livestock, crossfencing, and control of pollution are the main conservation objectives.

The major industries in the counties are electric cooperatives, and cement, marble, granite, graphite, and stone corporations. Tourist attractions are Pedernales Falls State Park, Blanco State Park, Inks Lake State Park, Lake Buchanan, Lake Lyndon B. Johnson, Longhorn Caverns, and Lake Travis.

At the present time, land in both counties is being bought and developed as homesites by people from nearby metropolitan areas.

Transportation

Blanco and Burnet Counties have an excellent network of state highways and roads. United States Highway 290 crosses Blanco County, and United States Highway 281 crosses both counties. The Southern Pacific Railroad services Burnet County.

Natural resources

The counties have an abundant supply of rock for building and road construction. Good quality water from springs, streams, and wells is plentiful. Most of the deep soils in the valleys are suitable for farming and pasture.

Climate

Because the climate in Blanco and Burnet Counties is similar, the data given in Table 1 and the data in the section following are from Blanco County only.

Blanco and Burnet Counties have a humid and subtropical climate with hot summers and mild winters. The mean annual rainfall in Blanco County is 34.39 inches. Rainfall is rather evenly distributed throughout the year, and the rainfall pattern, typical of that of the Edwards Plateau, has a double maxima in May and September. September is generally the wettest month and July, the driest. About 2/3 of the average annual rainfall is in April through October. Because a large part of this warm seasonal rainfall is the result of thunderstorm activity, the amount varies from year to year. Total annual precipitation in Blanco County has ranged from 55.06 inches in 1919 to 12.98 inches in 1901. In September 1952, 17.47 inches of rain fell at Blanco within a single 24-hour period. More than 8 inches have fallen within 24 hours in April and May.

Temperatures in the winter months are generally mild. Freezing temperatures occur 2 out of 5 nights during an average winter. The average daily maxima in January, the coldest month, is 60.3 degrees F. Frequent "northers" may bring sharp drops in temperature, but periods of cold weather are short and are soon moderated by sunshine and southerly winds. Cloudiness is most prevalent in winter. Precipitation is commonly in the form of light rain or drizzle. Significant amounts of snowfall are rare and snow generally melts as it falls. The lowest recorded temperature at Blanco is -6 degrees F.

Hot daytime temperatures prevail throughout the summer; however, cooler periods sometimes follow occasional thundershowers. Although the evaporation type of home air-conditioner operates efficiently about 90 percent of the time, the refrigeration type is preferred. The highest recorded temperature at Blanco is 110 degrees F.

Spring and fall are the most pleasant seasons of the year in Blanco and Burnet Counties. Temperatures are moderate. The weather is more changeable in spring than in fall. In October and November, there are long periods of fair weather with mild days and crisp, cool nights.

The mean relative humidity at Blanco at noon is 58 percent in January, 56 percent in April, 45 percent in July, and 53 percent in October. Mean percentage of total sunshine is 53 percent in winter, 58 percent in spring, 75 percent in summer, and 55 percent in fall. The prevailing wind is southerly from April through September and northerly from October through March.

The mean length of the warm season (the freeze-free period) is 234 days. In spring, the mean date from the last occurrence of 32 degrees F or below is on March 26. In fall, the mean date of the first occurrence of 32 degrees F or below is on November 15. The mean annual lake (free water) evaporation is 58 inches. Evaporation exceeds the rainfall by about 28 inches annually.

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 little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles, 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 established, the soil scientists drew the boundaries of the 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 map units. Some map units are made up of one kind of soil; others are made up of two or more kinds of soil; a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "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 interpretations of their behavior 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 available to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map 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, for the most part, suited to certain kinds of farming or to 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 soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in Blanco and Burnet Counties vary widely in their potential for major land uses. Table 2 shows the extent of the map units shown on the general soil map and gives general ratings of the potential of each, in relation to the other map units, for major land uses. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated crops, rangeland, recreational uses, urban uses,* and *sanitary facilities*. Cultivated crops are those grown extensively by farmers in the survey area. Rangeland is land where native vegetation is grazed by livestock. Intensive recreation areas include campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas include those used for nature study and as wilderness. Urban uses include residential, commercial, and industrial developments. Sanitary facilities include land used for septic tank absorption fields and trench type sanitary landfills.

At present, about 88 percent of the survey area is used for range, about 6 percent for cultivated crops, and 1 percent for pasture. Five percent is used for recreational and urban purposes or is inland water areas.

The general soil information in this section and more detailed information in the following sections can be used as a guide in planning the orderly growth and development of the counties.

Very shallow and shallow, gently sloping, undulating and hilly soils of the Edwards Plateau and Grand Prairie

The major soils in this group of map units are the Brackett, Doss, Eckrant, Hensley, Purves, and Tarpley soils. They formed in material weathered from marl and sandstone. The soils are well drained. Permeability is moderately slow to slow. Some soils are stony and cobbly.

Most of these soils are used as range. Native plants are little bluestem, sideoats grama, indiangrass, Texas wintergrass, live oak, and post oak.

These soils have low potential for cultivated crops, range, urban uses, and sanitary facilities. They have medium potential as recreational areas. Shallow rooting depth, rapid runoff, small stones, depth to rock, and slow permeability are some of the limitations.

This group makes up about 74 percent of the survey area.

1. Brackett-Purves-Doss

Shallow, loamy, and clayey, undulating and hilly soils on uplands; some soils are stony

The soils in this map unit are underlain by limestone and marl. Because the limestone layers are more resistant to weathering than the marl layers, the landscape has a stairstepped, or benched appearance.

This map unit makes up 55 percent of the survey area. It is about 37 percent Brackett soils, 15 percent Purves soils, 8 percent Doss soils, and 40 percent small areas of Bolar, Eckrant, Krum, and Real soils.

Brackett soils are on the sides of hills. The surface layer is pale brown clay loam about 5 inches thick. At a depth of 5 to 14 inches is light yellowish brown clay loam. Below this is pale yellow loam that is about 50 percent by volume soft calcium carbonate and layers of fractured limestone. Reaction is moderately alkaline.

Purves soils are on the tops of low hills and on less sloping areas. The surface layer is about 16 inches thick. It is very dark grayish brown stony clay in the upper part and brown cobbly clay in the lower part. The underlying material is hard limestone. Reaction is moderately alkaline.

Doss soils are on the less sloping lower parts of hills. The surface layer is dark grayish brown silty clay about 9 inches thick. At a depth of 9 to 17 inches is pale brown silty clay. The underlying layer is pink cemented caliche fragments. Reaction is moderately alkaline.

The soils in this map unit are dominantly open prairies that have scattered motts of live oak and juniper. They are better suited to native range and wildlife habitat than to other uses.

These soils have low potential for cultivated crops. The Brackett and Purves soils are too steep, too shallow, and too stony for cultivation; however, the Doss soils are suitable for cultivation. Depth to rock, stones and rock fragments, steep slopes, shallow rooting depth, and low available water capacity are limitations.

These soils have low potential for range. Shallow rooting depth, rapid runoff, low available water capacity, small stones, and steep slopes are limitations.

These soils have medium potential for recreational uses. Moderately slow permeability, steep slopes, a clayey surface, and stones are limitations.

The soils in this map unit have low potential for urban uses. Depth to rock, steep slopes, and shrinking and swelling when there are changes in moisture content are limitations. These soils have low potential for sanitary facilities. Depth to rock, moderately slow permeability, and a clayey surface layer are limiting features.

2. Hensley-Eckrant

Shallow, loamy and clayey, stony and cobbly, gently sloping to hilly soils on uplands

The soils in this map unit are on gently sloping to moderately steep hills and ridges.

This map unit makes up 11 percent of the survey area. It is about 26 percent Hensley soils, about 24 percent Eckrant soils, and 50 percent small areas of Brackett, Harper, Purvis, Spicewood, and Tarpley soils and Rock outcrops.

The Hensley soils are on gently sloping and undulating areas of uplands. The surface layer is reddish brown stony loam about 5 inches thick. At a depth of 5 to 18 inches is reddish brown clay. The underlying material is limestone bedrock. Reaction is neutral.

Eckrant soils are on the tops of low hills and on the side slopes of steep hills. The surface layer is very dark gray very cobbly clay 4 inches thick. It is about 40 percent by volume limestone cobbles. At a depth of 4 to 11 inches is very dark gray very cobbly clay that is about 60 percent limestone cobbles. The underlying material is fractured, indurated limestone bedrock. Reaction is neutral.

Most of the soils in this map unit are used for native range. A few areas of Hensley soils are cultivated.

These soils have low potential for cultivated farm crops. Shallow rooting depth, low available water capacity, and stoniness are limitations.

These soils have medium potential for range. Shallow rooting depth, rapid runoff, low available water capacity, and steep slopes are limitations.

These soils have low potential for recreational uses. Shallow depth to limestone bedrock, moderately slow and slow permeability, small stones, a clayey surface texture, and steep slopes are limitations.

The soils in this map unit have low potential for urban uses. Shallow depth to limestone bedrock, stoniness, and corrosivity to uncoated steel are some of the limitations. These soils have low potential for sanitary facilities. Shallow depth to limestone bedrock is the most limiting feature.

3. Eckrant-Brackett

Very shallow to shallow, clayey and loamy, undulating to hilly soils on uplands; some soils are cobbly

The soils in this map unit are on convex, undulating to rolling limestone ridges and adobe hills. The limestone layers are more resistant to weathering than the marl layers and the landscape has a stairstepped or benched appearance.

This map unit makes up 4 percent of the survey area. It is about 35 percent Eckrant soils, and about 31 percent Brackett soils and 34 percent small areas of Doss, Harper, Purves, and Tarpley soils and Rock outcrops.

Eckrant soils are on the tops of low hills. The surface layer is very dark gray cobbly and very cobbly clay about 11 inches thick. It is underlain by fractured limestone bedrock. Reaction is neutral.

Brackett soils are on the sides of hills. The surface layer is pale brown clay loam about 5 inches thick. At a depth of 5 to 14 inches is light yellowish brown clay loam about 9 inches thick. Below this, to a depth of 14 to 30 inches is pale yellow loam that is about 50 percent soft calcium carbonate and layers of fractured limestone. Reaction is moderately alkaline.

The soils in this map unit are on low hills that have motts of live oak and juniper. They are too shallow, too stony, and too steep for cultivation.

These soils have low potential for cultivated crops.

These soils have medium potential for range. Shallow rooting depth, rapid runoff, low available water capacity, small stones, and steep slopes are limitations.

These soils have low potential for recreational uses. Shallow depth to rock, moderately slow permeability, a clayey texture, and steep slopes are limitations.

The soils in this map unit have low potential for urban uses. Shallow depth to rock and steep slopes are limitations. The soils have low potential for sanitary facilities. Shallow depth to rock, steep slopes, and moderately slow permeability are limiting features.

4. Hensley-Tarpley

Shallow, clayey and loamy, gently sloping and undulating soils on uplands; some soils are stony

The soils in this map unit are on gently sloping to sloping uplands.

This map unit makes up 4 percent of the survey area. It is about 30 percent Hensley soils, 29 percent Tarpley soils, and 41 percent small areas of Harper and Eckrant soils.

Hensley soils are in the more sloping areas of the unit. The surface layer is reddish brown stony loam about 5 inches thick. At a depth of 5 to 18 inches is reddish brown clay. It is underlain by fractured, indurated limestone bedrock. Reaction is neutral.

Tarpley soils are in less sloping areas below the Hensley soils. The surface layer is dark reddish clay about 8 inches thick. At a depth of 8 to 15 inches is reddish brown clay. It is underlain by limestone bedrock. Reaction is neutral.

Only small areas of the nonstony soils in this map unit are suitable for cultivation; the rest is too stony and too shallow to be cultivated. The soils are better suited to native range and to wildlife habitat than to other uses.

These soils have low potential for cultivated crops. Shallow rooting depth, low available water capacity, and stoniness are limitations.

These soils have medium potential for range. Shallow rooting depth and low available water capacity are limitations. The range is dominantly a post oak-blackjack oak savannah.

These soils have low potential for recreational uses. Shallow depth, depth to limestone bedrock, a clayey surface, and stoniness are limitations.

The soils in this map unit have low potential for urban uses. Shallow depth to limestone bedrock, corrosivity to uncoated steel, and shrinking and swelling when there are changes in the moisture content are limitations. The soils have low potential for sanitary facilities. Shallow depth to limestone bedrock is the most limiting feature.

Deep, nearly level and gently sloping soils on foot slopes, terraces, and flood plains of the Edwards Plateau and Grand Prairie

The major soils in this group of map units are the Krum, Lewisville, Oakalla, and Weswood soils. These soils formed in alluvial sediment. They are well drained, and permeability is moderately slow to moderate.

These soils are used for cultivated crops, range, and improved pasture. The principal crops are grain sorghum, small grain, and grasses for hay and grazing. Native plants are big bluestem, indiangrass, Canada wildrye, and vine-mesquite.

These soils have high potential for cultivated crops, medium to high potential for range, low to medium potential for urban and recreational uses, and medium potential for sanitary facilities. Flooding, the high available water capacity, a clayey surface, and moderately slow and moderate permeability are limitations.

This group makes up about 9 percent of the survey area.

5. Krum-Lewisville

Deep, clayey, and loamy, nearly level and gently sloping soils on foot slopes and stream terraces

The soils in this map unit are on foot slopes and stream terraces below limestone hills.

This map unit makes up 7 percent of the survey area. It is about 65 percent Krum soils, about 15 percent Lewisville soils, and about 20 percent small areas of Bolar, Karnes, and Oakalla soils.

The gently sloping Krum soils have a clay surface layer about 27 inches thick that is very dark grayish brown in the upper part and dark grayish brown in the lower part. At a depth of 12 to 39 inches is brown clay. Below this to a depth of 72 inches is brown clay that has common limestone fragments. Reaction is moderately alkaline.

Lewisville soils have a dark grayish brown clay loam surface layer about 18 inches thick. At a depth of 18 to 58 inches is light yellowish brown clay loam that has masses of common calcium carbonate. Below this to a depth of 63 inches is yellowish brown clay loam that has many soft masses of calcium carbonate. Reaction is moderately alkaline.

Most of the soils in this map unit are cultivated. Small grain and sorghum are the principal crops. Pecan groves and improved pasture are in some areas. All of the soils in this association are suitable for cultivation.

The soils in this map unit have high potential for cultivated crops and for range.

These soils have medium potential for recreational uses. The clayey surface layer is a limitation.

The soils in this map unit have medium potential for urban uses. Shrinking and swelling when there are changes in moisture content, low strength, caving cut-

banks, and corrosivity to uncoated steel are limitations. The soils have medium potential for sanitary facilities. Moderately slow and slow permeability and a clayey surface layer are the limiting features.

6. Oakalla-Weswood

Deep, loamy, nearly level soils on bottom lands

The soils in this map unit are along streams.

This map unit makes up about 2 percent of the survey area. It is about 49 percent Oakalla soils, about 9 percent Weswood soils, and about 42 percent small areas of Lewisville and Krum soils. The Lewisville and Krum soils are on the higher adjoining stream terraces.

Oakalla soils have a surface layer of very dark grayish brown silty clay loam 23 inches thick. At a depth of 23 to 60 inches is brown silty clay loam. These soils are calcareous.

Weswood soils have a brown silt loam surface layer about 7 inches thick. At a depth of 7 to 60 inches is brown silt loam that has a few thin strata of very fine sandy loam. These soils are calcareous.

Most of the soils in this map unit are used for cultivated crops.

These soils have high potential for cultivated crops.

These soils have medium potential for range. Available water capacity, competition for moisture, and tree shade are limitations.

These soils have medium potential for recreational uses. A clayey surface, moderate permeability, and flooding are limitations.

The soils in this map unit have low potential for urban uses. Flooding is a limitation. These soils have medium potential for sanitary facilities. Flooding is the most limiting feature.

Very shallow, shallow, and deep, gently sloping to rolling soils of the Central Basin

The major soils in this group of map units are the Click, Eckert, Keese, Ligon, Luckenbach, Nebgen, Pedernales, and Voca soils. They formed in material weathered from granite, limestone, schist, sandstone, and calcareous loamy sediment. The soils are well drained and are slowly to rapidly permeable.

Most of these soils are used for native range and wildlife habitat. Native plants are little bluestem, sideoats grama, indiangrass, vine-mesquite, live oak, and post oak.

These soils have low to medium potential for cultivated crops, range, recreational uses, and urban uses. They have low potential for sanitary facilities. Shallow depth to rock, rapid runoff, and rapid permeability are some of the limitations.

This group makes up about 14 percent of the survey area.

7. Nebgen-Eckert-Ligon

Shallow and very shallow, loamy, undulating and rolling soils on uplands; some soils are stony

The soils in this map unit are on limestone, sandstone, and schist hills.

This map unit makes up 5 percent of the survey area. It is about 24 percent Nebgen soils, about 21 percent Eckert soils, about 8 percent Ligon soils, and about 47 percent small areas of Harper, Hye, Keese, Oben, and Renick soils and Rock outcrop.

Nebgen soils are in steeper areas in the unit. The surface layer is reddish brown fine sandy loam about 14 inches thick. The underlying material is sandstone. Reaction is neutral.

Eckert soils are in less sloping areas. The surface layer is dark brown stony loam about 7 inches thick. The underlying material is fractured limestone. Reaction is mildly alkaline.

Ligon soils are in undulating areas. The surface layer is reddish brown clay loam about 4 inches thick. The next layer is red clay loam about 11 inches thick. The underlying material is tilted, cemented schist. Reaction is neutral.

The soils in this map unit are dominantly on low, brushy hills that have whitebrush, post oak, live oak, and Texas persimmon trees. They are too shallow and too stony for cultivation. They are better suited to native range and wildlife habitat than to other uses.

These soils have low potential for cultivated crops. Shallow rooting depth, very low available water capacity, medium runoff, and stoniness are limitations.

These soils have low potential for range. Shallow rooting depth and very low available water capacity are limitations.

These soils have medium potential for recreational uses. Shallow depth to rock and small stones are limitations.

The soils in this map unit have low potential for urban uses. Shallow depth to rock and stoniness are limitations. These soils have low potential for sanitary facilities. Shallow depth to rock is the most limiting feature.

8. Voca-Click

Deep, loamy and gravelly, gently undulating and gently sloping soils on uplands

The soils in this map unit are on gently undulating prairie.

This map unit makes up about 4 percent of the survey area. It is about 45 percent Voca soils, about 10 percent Click soils, and 45 percent small areas of Eckert, Keese, Harper, and Oben soils and Rock outcrop.

Voca soils are in an intricate pattern with the other soils. They have a surface layer of brown gravelly sandy loam about 8 inches thick. At a depth of 8 to 28 inches is dark reddish brown or yellowish red gravelly clay.

Below this to a depth of 48 inches is red very gravelly clay that has a large amount of weathered granite. The underlying material is granite fragments that have a large amount of unweathered feldspar, quartz, and mica. Reaction is neutral to a depth of 48 inches.

Click soils have a surface layer of gravelly sandy loam about 13 inches thick. It is brown in the upper part and yellowish brown in the lower part. At a depth of 13 to 36 inches is gravelly sandy loam that is reddish brown in the upper part and light reddish brown in the lower part. Below this to a depth of 54 inches is partially weathered granite and gravelly sandy loam. The underlying material is indurated granite. Reaction is neutral to a depth of 36 inches.

Only a few small areas of soils in this map unit are cultivated. Small grain and tame pasture are the principal crops. Much of the unit is suited to native post oak and blackjack oak trees. The soils are better suited to range and wildlife habitat than to other uses.

These soils have low potential for cultivated crops. Low available water capacity, gravel, and a moderate to severe hazard of water erosion are limitations.

These soils have low potential for range. Low available water capacity is a limitation.

These soils have medium potential for recreational uses. Slow and moderately slow permeability of the Voca soils and small stones are the most limiting features.

The soils in this map unit have medium potential for urban uses. Depth to granite bedrock and the clayey subsoil of the Voca soils are limitations. The soils have low potential for sanitary facilities. Rapid permeability of the Click soils and depth to granite bedrock are the most limiting features.

9. Pedernales-Luckenbach

Deep, loamy, gently sloping soils on uplands and terraces

The soils in this map unit are on gently sloping concave areas.

This map unit makes up about 3 percent of the survey area. It is about 56 percent Pedernales soils, about 9 percent Luckenbach soils, and 35 percent small areas of Bolar, Heaton, Hensley, and Tarpley soils.

Pedernales soils have a surface layer of reddish brown fine sandy loam about 11 inches thick. At a depth of 11 to 38 inches is red sandy clay. Below this to a depth of 80 inches is reddish brown sandy clay. Reaction is neutral to a depth of 38 inches and moderately alkaline below.

Luckenbach soils have a clay loam surface layer about 17 inches thick that is dark reddish gray in the upper part and dark brown in the lower part. At a depth of 17 to 36 inches is reddish brown clay. Below this to a depth of 80 inches is clay loam that has fragments of hard calcium carbonate. It is reddish yellow in the upper part and very pale brown in the lower part. Reaction is mildly alkaline to a depth of 17 inches and moderately alkaline below.

About one-half of the soils in this map unit are cultivated. Sorghum, small grain, and tame pasture are the main crops. This association is suited to cultivated crops and range.

The soils have medium potential for cultivated crops. The moderately deep rooting zone, susceptibility to erosion, and slow movement of water, air, and roots through the soil are limitations.

These soils have medium potential for range. Medium available water capacity and medium surface runoff are limitations.

These soils have medium potential for recreational uses. A clayey surface layer and moderately slow permeability are limitations.

The soils in this map unit have medium potential for urban uses. Shrinking and swelling when there are changes in moisture content, low strength, corrosivity to uncoated steel, moderately slow permeability, and a clayey surface layer are limitations. The soils have low potential for sanitary facilities. Moderately slow permeability and a clayey surface layer are the most limiting features.

10. Keese-Nebgen

Shallow, loamy, rolling soils on uplands

The soils in this map unit are on rolling hills and ridges. They are underlain by granite and sandstone.

This map unit makes up 2 percent of the survey area. It is about 45 percent Keese soils, about 20 percent Nebgen soils, and about 35 percent small areas of Click, Hye, Ligon, Oben, and Voca soils and Rock outcrop.

Keese soils are on convex granite hills. The surface layer is light yellowish brown gravelly sandy loam about 9 inches thick. At a depth of 9 to 17 inches is strong brown gravelly sandy loam. The underlying material is indurated granite. Reaction is slightly acid.

Nebgen soils are on convex sandstone hills. The surface layer is brown fine sandy loam about 14 inches thick. At a depth of 14 to 19 inches is reddish brown, partially weathered cemented sandstone that has about 25 percent reddish brown fine sandy loam in fractures and interstices. The underlying material is strongly cemented sandstone. Reaction is neutral.

The soils in this map unit are used for native range and wildlife habitat.

These soils have low potential for cultivated crops. Shallow rooting depth, stoniness, very low available water capacity, and slope are limitations.

These soils have low potential for range. Shallow rooting depth, moderate to rapid runoff, and very low available water capacity are limitations.

These soils have medium potential for recreational uses. Shallow depth to granite or sandstone bedrock, slope, and rockiness are limitations.

The soils in this map unit have low potential for urban uses. Shallow depth to granite or sandstone bedrock, slope, and rockiness are the most limiting features. The soils have low potential for sanitary facilities. Shallow depth to granite or sandstone bedrock, slope, and rockiness are the most limiting features.

Shallow and moderately deep, gently sloping soils on uplands of the Edwards Plateau and Grand Prairie

The major soils in this map unit are the Bolar and Doss soils. They formed in material weathered from interbedded limestone and marl. The soils are well drained, and permeability is moderately slow and moderate.

These soils are used for cultivated crops and for range. The principal crops are grain sorghum, small grain, and grasses for hay and grazing. Native plants are sideoats grama, little bluestem, plains lovegrass, indiangrass, and live oak.

The soils have medium potential for cultivated crops, range, and urban uses. They have low potential for recreational uses and for sanitary facilities. The clayey surface layer, depth to rock, and slow permeability are some of the limitations.

This group makes up about 3 percent of the survey area.

11. Bolar-Doss

Shallow and moderately deep, loamy and clayey, gently sloping soils on uplands

The soils in this map unit are in concave valleys and on gently sloping prairie.

This map unit makes up 3 percent of the survey area. It is about 55 percent Bolar soils, about 25 percent Doss soils, and 20 percent small areas of Krum and Purves soils.

Bolar soils are on less sloping, concave or plane areas in this unit, below the Doss soils. The surface layer is dark grayish brown clay loam about 13 inches thick. At a depth of 13 to 33 inches is brown clay loam. The underlying material is cemented fragments of limestone and marl. Reaction is moderately alkaline.

Doss soils are on more sloping areas above the Bolar soils. The surface layer is dark grayish brown silty clay about 9 inches thick. At a depth of 9 to 17 inches is brown silty clay. The underlying material is fragments of pink cemented caliche. Reaction is moderately alkaline.

The soils in this map unit are used for range and cultivated crops. About one-third of the unit is cultivated. The rest is a range of open prairie that has scattered live oak motts.

These soils have medium potential for cultivated crops and for range. Low to medium available water capacity and a shallow to moderately deep rooting zone are limitations.

These soils have medium potential for recreational uses. A clayey surface layer and depth to rock are limitations.

The soils in this map unit have medium potential for urban uses. Depth to rock, low strength, shrinking and swelling when there are changes in moisture content, and corrosivity to uncoated steel are limitations. The soils have low potential for sanitary facilities. Depth to rock, moderately slow permeability, and a clayey surface layer are the most limiting features.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They 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 map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil 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.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is 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. The Hye series, for example, was named for the town of Hye in Blanco County.

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 characteristics that affect their use. 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, Bolar clay loam, 1 to 3 percent slopes, is one of several phases within the Bolar series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil associations. Most of the soil associations in the survey area are broadly defined units that are indicated by a subscript following the name of the map unit on the soil legend at the back of the survey. The broadly defined unit and the delineations are much larger and the composition more variable than other map units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Brackett-Real association, hilly, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map 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 map unit. These soils are described in the description of each map unit.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is 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.

1—Aledo association, undulating. This association is on uplands. It consists of shallow, gravelly, loamy soils that are underlain by limestone. Slopes range from 1 to 8 percent. The areas are irregular in shape and range from 40 to 450 acres in size.

Aledo soils make up about 65 to 90 percent of each mapped area. The rest is small areas of Bolar, Brackett, Doss, and Purves soils and outcrops of limestone and marl.

Typically, the Aledo soils have a surface layer of dark grayish brown, firm, gravelly clay loam about 4 inches thick that has about 25 percent by volume limestone pebbles and cobbles. At a depth of 4 to 13 inches is dark grayish brown, firm, very gravelly clay loam that has about 60 percent by volume angular limestone cobbles. The underlying material is coarsely fractured strongly cemented limestone (fig. 1). Reaction is moderately alkaline.

These soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow. Seeps are common after periods of high rainfall. The hazard of water erosion is severe.

The soils in this association have low potential for cultivated crops and tame pasture. Gravel, shallow rooting depth, and very low available water capacity are limitations.

These soils are used mainly for range; however, they have low potential for forage production. The range is made up of midgrasses, low growing scrub type plants, and scattered motts of live oak trees. Dominant vegetation is threeawns, red and Texas grama, hairy tridens, annual forbs and grasses, juniper, agarito, whitebrush, and mesquite.

These soils have low potential for wildlife habitat. The area, however, is used by deer, turkey, dove, quail, and other birds. Several plants in the area provide good cover, browse, fruits, and seeds for game birds and animals.

The soils in this association have medium potential for most recreational uses and low potential for most urban uses. Slope, a gravelly surface layer, shallow depth to limestone bedrock, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIs and Shallow range site.

2—Anhalt clay, 0 to 1 percent slopes. This moderately deep, nearly level soil is on uplands. The areas are mainly long and oval and range from 20 to 80 acres. The surface of the area in range is characterized by gilgai microrelief, which consists of microknolls and microdepressions. The microknolls are 4 to 12 inches higher than the bottoms of the microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

Typically, the surface layer is very firm, dark reddish brown clay about 9 inches thick. At a depth of 9 to 29 inches is very firm, dark reddish brown clay. The underlying material is indurated, fractured limestone (fig. 2). Reaction is neutral.

This soil is well drained. Runoff is slow. Permeability is very slow, and available water capacity is low. The root zone is moderately deep; clay content tends to impede movement of air, water, and roots. When this soil is dry, wide deep cracks are formed and water enters the soil rapidly. When the soil is wet, however, the cracks close and water enters very slowly. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Tarpley soil and small areas of a soil that is similar to Anhalt soil that has less than 60 percent clay between depths of 10 to 40 inches. Included areas make up less than 15 percent of the map unit.

This soil has medium potential for cultivated crops and high potential for tame pasture. Grain sorghum, oats, and wheat are the principal crops. If this soil is tilled continuously to the same depth, a plowpan can form. Use of crop residue helps to control water erosion, con-

serve moisture, improve soil tilth, and increase water intake rate.

This soil has high potential for native range plants. Production of tall and midgrasses is good in favorable years. The range is mostly an oak savannah. Dominant vegetation is Texas wintergrass, curlymesquite, buffalograss, ashe juniper, Texas persimmon, post oak, prickly-pear, and whitebrush.

This soil has medium potential for wildlife habitat. Deer, turkey, dove, and quail inhabit areas of this soil. Many plants provide good cover, browse, fruits, and seeds for game animals and birds.

This soil has low potential for recreational uses. A clayey surface layer and slow permeability are limitations.

This soil has low potential for most urban uses. Shrinking and swelling when there are changes in moisture content, low strength, corrosivity to uncoated steel, and moderate depth to limestone rock are limitations; most of these limitations, however, can be overcome by good design and careful installation procedures. Because the clay content of this soil restricts permeability, use of the soil for septic tank absorption fields is limited.

This soil is in capability subclass IIs and Deep Redland range site.

3—Anhalt clay, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes are slightly concave. The areas are irregular and range from 12 to 20 acres. The surface of the range areas is characterized by gilgai microrelief which consists of microknolls and microdepressions. The microknolls are 6 to 8 inches higher than the bottoms of the microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

Typically, the surface layer is very firm clay about 15 inches thick. It is reddish brown in the upper 6 inches and dark reddish brown in the lower 9 inches. At a depth of 15 to 29 inches is very firm, reddish brown clay that has intersecting slickensides. The underlying material is strongly cemented limestone and chert fragments that become weakly cemented as depth increases. Reaction is neutral.

This soil is well drained. Runoff is medium. Permeability is very slow, and available water capacity is low. The root zone is moderately deep; the clay content tends to impede movement of air, water, and roots. When this soil is dry, wide deep cracks are formed and water enters the soil rapidly. When the soil is wet, however, the cracks close and water enters very slowly. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Tarpley soil. Also included are small areas of a soil that is similar to Anhalt soil that has a surface layer of about 20 percent by volume chert pebbles and cobbles. The included soils make up less than 15 percent of the map unit.

This soil is used for cultivated crops, tame pasture, and range. Grain sorghum, oats, and wheat are the principal crops. Very slow permeability and low available water capacity are limitations. If the soil is tilled continuously to the same depth, a plowpan can form.

This soil has medium potential for cultivated crops and high potential for tame pasture crops.

This soil has low potential for recreational uses. The clayey surface layer and very slow permeability are limitations.

This soil has low potential for most urban uses. Shrinking and swelling when there are changes in moisture content, corrosivity to uncoated steel, and moderate depth to limestone rock are limitations. Most of these limitations, however, can be overcome by good design and careful installation procedures. Because the clay content of the soil restricts permeability, care is required in the installation of septic tank absorption fields.

This soil is in capability subclass IIIe and Deep Redland range site.

4—Bolar clay loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes are convex or concave. The areas are irregular or oval and range from 20 to 80 acres.

Typically, the surface layer is friable, moderately alkaline, dark grayish brown clay loam 13 inches thick. At a depth of 13 to 33 inches is friable, brown clay loam that has a few, small, rounded, soft bodies of calcium carbonate. Below this, extending to a depth of 38 inches, is mixed limestone pebbles and friable, brown clay loam. The underlying material is limestone and marl (fig. 3). Reaction is moderately alkaline.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is medium. However, the root zone is moderately deep; clay content tends to impede movement of air, water, and roots. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Doss, Krum, and Lewisville soils. They make up from 8 to 15 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, and wheat are the principal crops.

This soil has medium potential for cultivated crops and tame pasture. Low available water capacity is the main limitation. The root zone is deep and is easily penetrated by plants that have a vigorous root system. The soil has good tilth if it is cultivated at low moisture content. Terraces and contour farming help to control water erosion and conserve moisture. The use of crop residue helps maintain tilth and control erosion. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses in favorable years is good. Dominant vegetation is little bluestem, big bluestem, sideoats grama, Texas wintergrass, Texas cup-

grass, cane and pinhole bluestem, vine-mesquite, and some tall dropseed. Elm and hackberry trees are along small streams, and live oaks are widely scattered.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, limits use by deer and quail.

This soil has medium potential for recreational uses. The clay loam surface layer is a limitation.

This soil has medium potential for urban uses. Depth to rock and low strength are limitations that can be overcome by proper design and careful installation procedures.

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

5—Bolar clay loam, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands and the sides of hills. Slopes are concave. The areas are irregular or long and oval and range from 20 to 140 acres.

Typically, the surface layer is friable, very dark grayish brown clay loam 9 inches thick. At a depth of 9 to 17 inches is friable, dark brown clay loam. The next layer at a depth of 17 to 32 inches is friable, brown clay loam that has vertical streaks of darker soil. Below this, extending to a depth of 38 inches, is light brown clay loam that has soft and cemented bodies of calcium carbonate. The underlying material is limestone and marl. Reaction is moderately alkaline.

This soil is well drained. Runoff is rapid. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep; clay content, however, impedes movement of air, water, and roots. The hazard of water erosion is moderate.

Included with this soil in mapping are small narrow areas of Brackett soil and oval shaped areas of Doss soil. The included soils make up 5 to 15 percent of the map unit.

This soil has medium potential for cultivated crops and tame pasture. Grain sorghum, oats, wheat, and tame pasture are the principal crops. The root zone is moderately deep and is easily penetrated by plants that have vigorous root systems. This soil has good tilth if it is cultivated at low moisture content. Terraces and contour farming help control water erosion and conserve moisture. The use of crop residue helps maintain tilth and control erosion. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses in favorable years is good. Dominant vegetation is little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed. Elm and hackberry trees occur along small streams, and live oak motts are widely spaced.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover is a limitation for deer and quail.

This soil has medium potential for recreational uses. The clay loam surface layer is a limitation.

This soil has medium potential for most urban uses. Depth to rock, low strength, moderate shrinking and swelling when there are changes in moisture content, and slope are limitations that can be overcome by good design and careful installation procedures.

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

6—Brackett association, undulating. This is an association of shallow, loamy soils on hills and upland foot slopes. Slopes range from 1 to 8 percent. The areas are long and oval or irregular and range from 120 to 1,500 acres. The low, rounded hills have exposed bands or ledges of limestone that are perpendicular to the slope. In places, angular and rounded limestone pebbles and cobbles are on the surface.

Brackett soils make up about 80 to 95 percent of each mapped area. The rest is small areas of Bolar, Doss, Eckrant, Krum, and Purves soils.

Typically, the Brackett soils have a surface layer of very friable, pale brown clay loam about 5 inches thick. At a depth of 5 to 14 inches is friable, light yellowish brown clay loam that has common limestone pebbles. The underlying material is marl and limestone (fig. 4). Reaction is moderately alkaline.

These soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is low. The root zone is shallow. Seeps are common after periods of high rainfall. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops or tame pasture. Shallow depth, slope, high content of lime, and low available water capacity are limitations.

These soils are used mainly for range. However, the shallow rooting depth, low available water capacity, and rapid runoff limit the amount of forage production even in favorable years. The range is a savannah that has scattered motts of live oak and Texas oak. In most places, there is less than 10 percent oak overstory. The understory is dominated by midgrasses, for example, little bluestem, sideoats grama, and tall grama. A variety of forbs and some sedges grow on these soils.

These soils have medium potential for wildlife habitat. The area is used by deer, dove, and quail. Several woody plants, forbs, and grasses in the area provide good cover, browse, fruits, and seeds for wildlife (fig. 5).

These soils have medium to high potential for most recreational uses. Moderately slow permeability and depth to rock are limitations.

The soils in this association have low to medium potential for urban uses. Depth to rock and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIs and Adobe range site.

7—Brackett-Real association, hilly. This association consists of shallow, loamy soils on uplands. Slopes are convex and range from 10 to 30 percent. Areas are oblong or irregular and range from 350 to 6,000 acres. Horizontal limestone outcrops give the slopes a stair-stepped, or benched appearance. Angular limestone pebbles and cobbles are on the surface of some areas (fig. 6).

The Brackett soils make up an average of about 55 percent of the association, but range from 40 to 65 percent of each mapped area. These soils are on the sides of hills in areas between the Real soils. The Real soils make up about 35 percent of the association but range from 25 to 45 percent of each mapped area. They are in long, narrow, continuous bands that range from 25 to 300 feet in width and are perpendicular to the slope. These soils were not mapped separately because use and management are similar. The rest is small areas of Doss, Eckrant, Purves, and Tarpley soils.

Typically, the Brackett soils have a surface layer of friable, light brownish gray clay loam 7 inches thick that has a few soft bodies of calcium carbonate. At a depth of 7 to 19 inches is friable, pale brown clay loam that has soft bodies of calcium carbonate. It is underlain by a layer of weakly cemented limestone, soft chalky earth, and light brownish gray loam. Reaction is moderately alkaline.

The Brackett soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is low. The hazard of water erosion is severe.

Typically, the Real soils have a surface layer of friable, dark grayish brown, gravelly clay loam about 8 inches thick. At a depth of 8 to 15 inches is friable, dark grayish brown, very gravelly clay loam that contains 60 percent angular limestone pebbles. The underlying material is cemented limestone and marl.

The Real soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is very low. Seeps are common after periods of high rainfall. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops and tame pasture. Shallow rooting depth, steep slopes, high lime content, and low and very low available water capacity are limitations.

These soils are used mainly for range. They have medium potential for native range plants. The range is an oak savannah that has live oak and Texas oak trees. Dominant grasses are little bluestem, sideoats grama, tall grama, tall dropseed, seep and canyon muhly, and purple threeawn.

These soils have low potential for wildlife habitat. The area, however, is used by deer, dove, and quail. Because of the topography, protective cover, and palatable browse plants, the area is especially favorable for deer. Several species of small animals and songbirds, including the golden-cheeked warbler, are native to this site.

The soils in this association have medium potential for most recreational uses and low potential for most urban uses. Slope, shallow depth to limestone rock, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIIs and Steep Adobe range site.

8—Click gravelly sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are plane to convex. The areas are irregular and range from 40 to 250 acres.

Typically, the surface layer is about 14 inches thick. It is very friable, brown sandy loam that contains granite gravel in the upper part and is very friable, yellowish brown gravelly sandy loam in the lower part. At a depth of 14 to 26 inches is very friable, reddish brown gravelly sandy loam. The next layer at a depth of 26 to 36 inches is very friable, light reddish brown gravelly sandy loam. Below this, extending to a depth of 54 inches, is mixed very friable, yellowish brown gravelly sandy loam and pink weathered granite. The underlying material is pink, indurated and fractured granite. Reaction is slightly acid.

This soil is somewhat excessively drained. Runoff is very slow. Permeability is rapid, and available water capacity is very low. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Keese and Voca soils and some small spots of granite rock outcrop. They make up 8 to 15 percent of the map unit.

This soil is not suited to cultivated crops and tame pasture. It is used for range.

This soil has medium potential for native range plants. The range is an open savannah of post oak, blackjack oak, and live oak that has mid- and tall grasses in thin stands. Dominant vegetation is mesquite, persimmon, whitebrush, condalia, ashe juniper, gummy lovegrass, Texas grama, coneflower, and basin sneezeweed. Many annual forbs and grasses grow on this soil and the mineral content of the grasses is high, but production of tall and mid grasses is low, even in favorable years.

This soil has medium potential for wildlife habitat. The areas are used by deer, quail, squirrel, dove, and several species of nongame birds and small animals.

This soil has high potential for recreational uses. Small stones, however, limit some playground uses.

This soil has low potential for most urban uses. Depth to rock and rapid permeability are limitations.

This soil is in capability subclass VIs and Granite Gravel range site.

9—Doss silty clay, 1 to 5 percent slopes. This shallow, gently sloping soil is on uplands. It is underlain by cemented caliche. The areas are oblong and range from 30 to 180 acres.

Typically, the surface layer is firm, dark grayish brown silty clay about 9 inches thick. At a depth of 9 inches to 17 inches is firm, brown silty clay that has many bodies of calcium carbonate. The underlying material is a bed of pink cemented caliche that becomes softer as depth increases (fig. 7). Reaction is moderately alkaline.

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

Included with this soil in mapping are small areas of Bolar and Brackett soils. Also included are small circular areas of a soil similar to Doss soil that has a clay loam surface layer. The included soils make up 5 to 15 percent of the map unit.

This soil has medium potential for cultivated crops and tame pasture. Grain sorghum, oats, and wheat are the main crops. The hazard of erosion limits cultivation of this soil. Contour farming and terraces are needed to control water erosion. The soil responds to application of fertilizer. Nitrogen and phosphorus are needed. The use of crop residue helps maintain good tilth, conserve moisture, and control erosion.

This soil has medium potential for native range plants. The range is open grassland that has mid grasses and scattered live oak motts. In favorable years, production of tall and mid-grasses is moderate. Dominant grasses are little bluestem, sideoats grama, pinhole bluestem, and buffalograss.

This soil has medium potential for wildlife habitat. The areas are used by deer, turkey, dove, quail, and other birds. Several plants that grow on this soil provide good cover, browse, fruits, and seeds for game birds and animals.

This soil has low potential for most urban uses. A clayey texture, depth to rock, low strength, shrink-swell potential, corrosivity to uncoated steel, and moderately slow permeability are limitations. Slow permeability limits use for septic tank absorption fields. If cuts or excavations exceed about 17 inches, there is a hazard of cutting into cemented caliche.

This soil has low potential for recreational uses. The clayey surface layer is the main limitation.

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

10—Eckert-Rock outcrop association, rolling. This association consists of very shallow, loamy soils and Rock outcrop on broad hills and uplands. Slopes are convex and range from 5 to 16 percent. The areas are irregular and range from 200 to 3,600 acres. The low, flattop hills are rounded or irregular in shape and generally slope to the southeast. Smooth, angular and rounded flagstones from 6 to 13 inches across are on the surface. Some stones are as much as 35 inches across.

Eckert stony loam makes up an average of 50 percent of the association but range from 40 to 65 percent of each mapped area. Rock outcrop makes up an average of about 25 percent of the association. The rest is small areas of Harper and Tarpley soils, and a soil that is similar to Eckert soil that is clay loam. Angular limestone gravel and rounded stones cover 40 to 55 percent of the surface.

Typically, the Eckert soil has a surface layer of very friable, dark brown stony loam about 7 inches thick. The underlying material is fractured, coarse grained crystalline limestone. Reaction is moderately alkaline.

These soils are well drained. Runoff is medium to rapid. Permeability is moderate, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The roughly circular Rock outcrops are rarely more than 6 inches high and are partially covered with as much as 3 inches of soil. They range from 3 to 16 feet across. The bedrock is generally tilted toward the southeast about 5 degrees from horizontal. It is layered and is as much as 50 feet thick. The layers are 4 inches to as much as 21 inches thick. The bedrock is fractured and individual fragments that are 6 inches to more than 20 feet across.

The soils in this association are suited only to range. However, they have low potential for native range plants. Vegetation consists of scattered, scrubby live oak and elm trees, mid- and tall grasses, and forbs. Dominant grasses are little bluestem, sideoats grama, sand lovegrass, and green sprangletop. Grasses make up about 80 percent of the total annual production on this soil; woody plants, about 10 percent; and forbs, about 10 percent.

These soils have low potential for wildlife habitat. The areas, however, are used by deer, dove, and quail.

These soils have low potential for recreational uses. Stones on the surface and slope are limitations.

The soils in this association have low potential for urban uses. Depth to rock is a limitation.

Eckert soils are in capability subclass VIIs and Stony Loam range site. Rock outcrop is not assigned to a capability subclass or a range site.

11—Eckrant association, undulating. This association consists of shallow, cobbly clay on the tops of hills. Slopes are convex and range from 1 to 8 percent. The areas are irregular and range from 150 to 600 acres.

Eckrant soils make up an average of about 50 percent of the association but range from 40 to 90 percent of each mapped area. The rest of the association is Rock outcrop and small areas of Aledo, Brackett, Purves, and Tarpley soils.

Typically, the Eckrant soils have a surface layer of firm, very dark gray very cobbly clay 4 inches thick that

has 60 percent by volume limestone pebbles and cobbles. At a depth of 4 to 11 inches is firm, very dark gray very cobbly clay that has 60 percent by volume limestone pebbles and cobbles. The underlying material is thick, indurated limestone bedrock that is fractured. Pebbles, cobbles, and stones cover as much as 50 percent of the surface (fig. 8). Reaction is neutral.

These soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The soils in this association are not suitable for cultivated crops or tame pasture.

These soils are used for range. They have medium potential for native range plants. Rapid runoff and restricted rooting depth limit the amount of forage production in favorable years. The range is a live oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, switchgrass, sideoats grama, tall dropseed, feathery bluestem, green sprangletop, vine-mesquite, Texas wintergrass, and Texas cupgrass.

These soils have medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Cover is adequate and browse, forbs, and grasses furnish a year-round supply of food.

The soils in this association have low potential for most recreational and urban uses. Slopes, a cobbly surface layer, shallow depth to limestone bedrock, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIIs and Low Stony Hills range site.

12—Eckrant-Rock outcrop association, hilly. This association consists of shallow, cobbly, clay soils on the sides of long, narrow limestone hills. Slopes are convex and range from 10 to 30 percent. The areas are long and narrow, generally follow the contour of the hillsides, and range from 80 to 240 acres.

Eckrant soils make up an average of about 65 percent of the association, but range from 50 to 75 percent of each mapped area. Rock outcrop makes up an average of about 25 percent of the association, but ranges from 20 to 40 percent of each mapped area. The rest of the association is small areas of Tarpley soils that make up 5 to 10 percent of each mapped area.

Typically, the Eckrant soils have a surface layer of firm, very dark grayish brown very cobbly clay 6 inches thick. It has 55 percent by volume limestone cobbles. At a depth of 6 to 12 inches is firm, very dark grayish brown very cobbly clay that has 60 percent by volume limestone cobbles. The underlying material is fractured, indurated limestone bedrock. Cobbles and stones cover as much as 70 percent of the surface. Reaction is neutral.

These soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The Rock outcrops are as much as 6 inches high and some outcrops are partially covered with as much as 3 inches of soil. They range from 3 to 15 feet across. The layered bedrock is as much as 50 feet thick. Fractured fragments of bedrock range from 6 inches to more than 20 feet in thickness.

The soils in this association are not suited to cultivated crops or tame pasture. The very cobbly surface layer, shallow rooting depth, slope, and very low available water capacity are limitations.

These soils are used for range. They have medium potential for native range plants. The range is a live oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, switchgrass, sideoats grama, tall dropseed, feathery bluestem, green sprangletop, vine-mesquite, Texas wintergrass, and Texas cupgrass.

These soils have medium potential for wildlife habitat. The area is used by deer, dove, and quail. Cover is adequate, and browse, forbs, and grasses provide a year-round supply of food.

The soils in this association have low potential for most recreational and urban uses. Slopes, a very cobbly surface layer, shallow depth to limestone bedrock, large stones, and corrosivity to uncoated steel are limitations.

Eckrant soils are in capability subclass VIIs and Steep Rocky range site. Rock outcrop is not assigned to a capability subclass or a range site.

13—Harper-Rock outcrop association, undulating. This association consists of shallow, undulating soils and limestone Rock outcrop on the crests of low stony hills. Slopes are convex and range from 1 to 8 percent. The areas are irregular and range from 80 to 420 acres. Rounded, oblong boulders that range from 3 to 7 feet in length and from 6 to 20 inches in thickness are on the surface.

Harper soils range from 45 to 65 percent of each mapped area. Rock outcrop and soils less than 4 inches thick make up an average of about 25 percent of the association, but range from 15 to 45 percent of each mapped area. Also included are the Eckert, Eckrant, and Tarpley soils which make up 10 to 20 percent.

Typically, the Harper soils have a surface layer of firm, black clay about 18 inches thick. It is about 10 percent pebbles and cobbles. The underlying material is indurated, fractured, crystalline, dolomitic limestone. Reaction is moderately alkaline.

These soils are well drained. Runoff is low. Permeability is moderately slow, and available water capacity is low. The root zone is shallow. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops or tame pasture crops.

These soils are used mainly for range. They have medium potential for native range plants. Low available moisture capacity and restricted rooting depth limit forage production in favorable years. The range is a live

oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, switchgrass, sideoats grama, tall dropseed, feathery bluestem, green sprangletop, vine-mesquite, Texas wintergrass, and Texas cupgrass.

These soils have low potential for wildlife habitat. The areas are used by deer, dove, and quail. Cover is adequate, and browse, forbs, and grasses furnish a year-round supply of food.

The soils in this association have low potential for most recreational and urban uses. Depth to rock, rock outcrop, and stoniness are limitations that are difficult to overcome. The limestone bedrock is not rippable with a 300 horsepower excavator; blasting needs to be used to excavate the limestone bedrock.

Harper soils are in capability subclass VIs and Stony Upland range site. Rock outcrop is not assigned to a capability subclass or a range site.

14—Heaton loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping sandy soil is on uplands. Slopes are convex. The areas are irregular and range from 20 to 30 acres.

Typically, the surface layer is 22 inches thick. It is very friable, brown loamy fine sand in the upper part, and very friable, reddish brown loamy fine sand in the lower part. The next layer at a depth of 22 to 37 inches is friable, red sandy clay loam. Below this to a depth of 68 inches is friable, yellowish red sandy clay loam. The underlying layer, extending to a depth of 80 inches, is friable, reddish brown sandy clay loam that has a few fragments of weathered sandstone. Reaction is neutral.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is medium. The root zone is deep. Air, water, and roots move easily through the soil. This soil is easily tilled. It responds well to application of fertilizer. Nitrogen and phosphorus are needed. There is a slight hazard of wind erosion on this soil if it is cultivated and the surface layer is bare. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Pedernales soil, and a soil similar to Heaton soil that has a surface layer less than 2 inches thick.

This soil has medium potential for cultivated crops and tame pasture, and high potential for orchards. Grain sorghum, oats, tame pasture, and peaches are the principal crops. The soil has high potential for peaches. The use of crop residue helps to control water and wind erosion, conserve moisture, and improve soil tilth. Contour farming and closely spaced crops are needed to control water erosion.

This soil has medium potential for native range plants. Production of tall and midgrasses in favorable years is good. The range is made up of mixed post oak, grasses, and forbs. Relatively large trees grow on this site. Dominant plants are little bluestem, sand lovegrass, mat sandbur, threeawns, and prairie coneflower.

This soil has high potential for wildlife habitat. The areas are used by deer, turkey, quail, dove, and several species of nongame birds and small animals.

This soil has low to medium potential for recreational uses. The sandy surface texture is a limitation.

This soil has high potential for most urban uses. Banks can cave if shallow excavations are made. The soil has moderate corrosivity to uncoated steel.

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

15—Hensley loam, 1 to 3 percent slopes. This shallow, gently sloping soil is underlain by limestone. Slopes are convex. The areas are irregular and range from 20 to 60 acres.

Typically, the surface layer is firm, reddish brown loam about 5 inches thick that has about 15 percent by volume angular quartz and chert pebbles in the soil and on the surface. At a depth of 5 to 14 inches is very firm, reddish brown clay loam that has 15 percent by volume of angular pebble size quartz and chert fragments. The underlying material is quartz fragments and indurated limestone bedrock.

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

Included with this soil in mapping are small areas of Pedernales soil, a soil similar to Hensley soil that has a surface layer of clay loam or sandy clay loam, and a few spots of limestone outcrop. The included areas make up 5 to 15 percent of the map unit.

This soil has medium potential for cultivated crops and tame pasture. Grain sorghum and oats are the main crops. Shallow rooting depth and very low available water capacity are limitations. The use of crop residue helps control water erosion, conserve moisture, improve soil tilth, and increase the water intake rate. Contour farming is needed in most areas to control water erosion. Cutting into limestone bedrock is a hazard if cuts or excavations exceed 14 inches.

This soil has medium potential for native range plants. Production of midgrasses is medium in favorable years. The range is an oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruit, and seeds for wildlife.

This soil has medium potential for recreational uses. Depth to rock is a limitation that is difficult to overcome.

This soil has low potential for most urban uses. Depth to rock and corrosivity to uncoated steel are limitations.

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

16—Hensley loam, 3 to 5 percent slopes. This shallow, gently sloping soil is underlain by limestone. Slopes are convex. Areas are roughly long and oval and range from 25 to 125 acres.

Typically, the surface layer is firm, reddish brown loam 5 inches thick. At a depth of 5 to 15 inches is firm, red clay. The underlying material is fractured limestone bedrock.

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

Included with this soil in mapping are small areas of Doss and Pedernales soils, and a few small areas of Rock outcrop and gravelly soil. They make up 8 to 20 percent of the map unit.

This soil has low potential for cultivated crops and tame pasture. Grain sorghum, grasses for hay, and oats are the principal crops. The use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase the water intake rate. Contour farming is needed in most areas to control water erosion. Cutting into limestone bedrock is a hazard if cuts or excavations exceed about 15 inches.

This soil has low potential for native range plants. Shallow rooting depth and low available moisture limit the production of mid and tall grasses in favorable years. The range is an oak savannah that has post, blackjack, and Texas oak. Dominant grasses are indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruits, and seeds for wildlife.

This soil has low potential for most urban uses. Depth to limestone bedrock and corrosivity to uncoated steel are limitations. This soil has medium potential for recreational uses. Depth to limestone bedrock is a limitation that is difficult to overcome.

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

17—Hensley association, undulating. This association consists of shallow, stony, loamy soils that are underlain by limestone. Slopes are convex and range from 1 to 8 percent. The areas are irregular and range from 40 to 400 acres. Limestone and dolomite outcrops, limestone fragments, and angular and rounded chert fragments are in spots, patches, and narrow bands. The spots and patches are a few feet across; the bands are 10 to as much as 70 feet across and range from 50 to 700 feet long.

Hensley soils make up an average of 80 percent of each mapped area. The rest of the association is small areas of Anhalt, Pedernales, and Tarpley soils.

Typically, the Hensley soils have a surface layer of very friable, reddish brown stony loam about 5 inches thick that has about 15 percent by volume angular quartz and chert pebbles. About 20 percent of the surface is covered by limestone and quartz fragments. At a depth of 5 to 18 inches is firm, reddish brown clay that has about 15 percent by volume angular quartz and chert pebbles. The underlying material is indurated, fractured limestone bedrock (fig. 9). Reaction is neutral.

These soils are well drained. Runoff is medium. Permeability is slow, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion hazard is severe.

The soils in this association are not suited to cultivated crops or tame pasture.

These soils are used for range. They have medium potential for native range plants. The range is an oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

These soils have medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruits, and seeds for wildlife.

These soils have low potential for recreational uses. Depth to limestone bedrock and stoniness are limitations that are difficult to overcome.

These soils have low potential for most urban uses. Depth to limestone bedrock, stoniness, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIs and Redland range site.

18—Houston Black clay, 0 to 1 percent slopes. This deep, nearly level soil is in smooth, shallow valleys on uplands. Slopes are slightly concave. The areas are irregular and range from 35 to 80 acres. In virgin areas, the surface has a gilgai microrelief which consists of microknolls and microdepressions. The microknolls are 6 to 10 inches higher than the microdepressions. Cycles of these microknolls and microdepressions occur every 10 to 24 feet. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

Typically, the surface layer in the center of a microdepression is very firm, dark gray clay 42 inches thick. At a depth of 42 to 80 inches is very firm, grayish brown clay. Reaction is moderately alkaline.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow. When this soil is dry, wide, deep cracks extend to

the surface, and water enters the soil rapidly. The hazard of water erosion is slight. Wetness is a hazard after a period of heavy rainfall.

Included with this soil in mapping are small areas of Bolar and Doss soils. They make up less than 10 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, and grasses for hay and tame pasture are the main cultivated crops.

This soil has high potential for cultivated crops and tame pasture. The root zone is deep; however, clay content tends to impede movement of air, water, and roots. The soil has good tilth and needs to be worked at a low moisture content. If the soil is tilled continuously to the same depth, a plowpan can form. The use of crop residue helps to conserve moisture, improve tilth, and increase water intake. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has high potential for native range plants. Production of tall and mid grasses in favorable years is good. The range is tall grass prairie that has a few large live oak, elm, and hackberry motts. Dominant grasses are little bluestem, big bluestem, indiangrass, Texas wintergrass, and sideoats grama.

This soil has medium potential for wildlife habitat. The areas are used by dove and quail.

This soil has low potential for recreational uses. The clayey surface layer and very slow permeability are limitations.

This soil has low potential for most urban uses. Shrinking and swelling when there are changes in moisture content, low strength, caving of cutbanks, corrosivity to uncoated steel, and a clayey texture are limitations. Most of these limitations, however, can be overcome by good design and careful installation procedures. Because the clayey texture of this soil restricts permeability, good design of septic tank absorption fields is needed.

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

19—Houston Black clay, 1 to 3 percent slopes. This deep, gently sloping soil on the sides of smooth, shallow valleys is on uplands. Slopes are concave. The areas are oval and range from 40 to 150 acres. In virgin areas, the surface is characterized by gilgai microrelief that consists of microknolls and microdepressions. The microknolls are 4 to 8 inches higher than the microdepressions. Cycles of microknolls and microdepressions occur every 10 to 24 feet. Evidence of microrelief is destroyed after a few years of cultivation.

Typically, the surface layer in the center of a microknoll is very firm, dark gray clay 28 inches thick. At a depth of 28 to 54 inches is very firm, pale olive clay. Below this, extending to a depth of 80 inches, is very firm, light gray clay that has olive mottles. Reaction is moderately alkaline.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. When this soil is dry, wide deep cracks are formed and water enters the soil rapidly. When the soil is moist, however, the cracks close and water enters slowly. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Bolar and Doss soils, and a soil similar to Houston Black soil which has chroma of more than 1.5 at a depth of 30 to 60 inches. The included soils make up less than 10 percent of the map unit.

This soil has high potential for cultivated crops and tame pasture. Grain sorghum, oats, wheat, and grasses for hay are the principal crops. The root zone is deep; however, clay content tends to impede movement of air, water, and roots. The soil has good tilth and needs to be worked at a low moisture content. If the soil is tilled continuously to the same depth, a plowpan can form. The use of crop residue helps to conserve moisture, improve tilth, and increase water intake. Contour farming and terraces are needed to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has high potential for native range plants. Production of tall and midgrasses is good in favorable years. The range is tall grass prairie that has a few large live oak, elm, and hackberry motts. Dominant grasses are little bluestem, big bluestem, indiangrass, Texas wintergrass, and sideoats grama.

This soil has medium potential for wildlife habitat. The areas are used by dove and quail.

This soil has low potential for recreational uses. The clayey surface layer and very slow permeability are limitations.

This soil has low potential for most urban uses. Shrinking and swelling when there are changes in moisture content, low strength, caving of cutbanks, corrosivity to uncoated steel, and a clayey texture are limitations. Most of these limitations can be overcome by good design and careful installation procedures. Because the clayey texture of this soil restricts permeability, good design of septic tank filter fields is needed.

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

20—Hye fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on erosional uplands. Slopes are convex or plane. The areas are roughly oval and range from 20 to 65 acres.

Typically, the surface layer is very friable, brown fine sandy loam about 12 inches thick. At a depth of 12 to 18 inches is very friable, reddish brown fine sandy loam. The next layer at a depth of 18 to 26 inches is friable, reddish brown sandy clay loam. Below this, extending to a depth of 36 inches, is friable, yellowish red sandy clay

loam that has a few small weathered sandstone fragments. The underlying material is indurated sandstone bedrock. Reaction is neutral to a depth of about 12 inches and slightly acid below.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is low. The root zone is moderately deep, and air, water, and roots move easily through the soil. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Oben and Pedernales soils. Also included are small areas of a soil similar to Hye soil that has sandstone below a depth of 40 inches. The inclusions make up less than 15 percent of the map unit.

This soil has medium potential for cultivated crops and tame pasture. Grain sorghum, oats, and wheat are the principal crops. The use of crop residue helps control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming and terraces are needed in most areas. Grassed waterways provide good outlets for terrace systems if excess water is a problem. If cuts or excavations exceed 36 inches, there is a hazard of cutting into the underlying indurated sandstone. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is medium in favorable years. The range is a live oak-post oak savannah. Trees grow to a relatively large size on this soil. Live oak is more abundant than post oak. Dominant grasses are little bluestem, sandhill lovegrass, sand dropseed, grassbur, and prairie coneflower.

This soil has medium potential for wildlife habitat. The areas are used by deer, turkey, quail, dove, and several species of nongame birds and small animals.

This soil has high potential for recreational uses. Slope is a limitation.

This soil has medium potential for most urban uses. Depth to sandstone is a limitation; however, this limitation can be overcome by good design and careful installation procedures. Because depth to rock limits use for septic tank absorption fields, the absorption area needs to be increased in size or modified in design. Seepage along the top of the sandstone is a pollution hazard to nearby water sources.

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

21—Karnes loam, 1 to 3 percent slopes. This deep, gently sloping soil is on flood plains near streams. Slopes are mostly convex. The areas are long and narrow and range from 20 to 45 acres.

Typically, the surface layer is friable, grayish brown loam about 11 inches thick. At a depth of 11 to 23 inches is friable, pale brown loam. The next layer at a depth of 23 to 49 inches is firm, light yellowish brown loam that has threads of calcium carbonate. Below this, extending to a depth of 72 inches, is friable, yellowish brown clay loam that has threads and soft or cemented bodies of calcium carbonate. Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep, and air, water, and roots move through the soil easily. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Oakalla soil, Lewisville soil, and stream channels which are less than 100 feet wide. The inclusions make up less than 10 percent of the map unit.

This soil has medium potential for cultivated crops and low potential for tame pasture. Grain sorghum, oats, and wheat are the principal crops. The use of crop residue helps to control water erosion and conserve moisture. It also helps to improve soil tilth, and increase water intake by preventing sealing of the soil surface. Contour farming and terraces are needed in most areas to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil has a high content of lime which causes chlorosis, or a yellowing of the leaves, of some crops.

This soil has medium potential for native range plants. Production of tall and mid grasses is medium in favorable years. This range is mostly a tall grass prairie. Elm and hackberry trees grow along small streams, and live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, is a limitation for deer and quail.

This soil has high potential for recreational uses.

This soil has high to low potential for urban uses. It has high potential for septic tank absorption fields. Seepage is a limitation for sanitary landfills and sewage lagoons. This soil is corrosive to uncoated steel.

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

22—Katemcy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes are plane to concave. The areas are irregular or oval and range from 50 to 400 acres.

Typically, the surface layer is firm, reddish brown loam 9 inches thick. Quartz pebbles are on the surface. At a depth of 9 to 28 inches is very firm, reddish brown clay. Below this, extending to a depth of 35 inches, is dark reddish brown, gravelly clay loam. The underlying material is fractured, indurated, tilted schist.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is low. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Ligon and Eckert soils, and a few outcrops of quartz and schist. These inclusions make up less than 20 percent of the map unit.

This soil has low potential for cultivated crops and tame pasture. It is used for range. The root zone is moderately deep; clay content, however, impedes the movement of air, water, and roots. If this soil is tilled continuously to the same depth, a plowpan tends to form.

This soil has medium potential for native range plants. Production of tall and midgrasses is medium in favorable years. The range is grassland that has a few scattered live oak trees. Dominant vegetation consists of Texas wintergrass, fall witchgrass, hairy tridens, threeawns, Texas persimmon, whitebrush, and post oak.

This soil has medium potential for wildlife habitat. The areas are used by deer, turkey, dove, quail, and several species of nongame birds and small animals.

This soil has medium potential for recreational uses. The clay loam surface layer and slow permeability are limitations.

This soil has medium potential for most urban uses; however, it has low potential for septic tank absorption fields. Depth to rock and slow permeability in the clayey underlying layers are limitations.

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

23—Keese-Rock outcrop association, rolling. This association consists of shallow, gravelly sandy loam and Rock outcrop on uplands. Slopes are convex and range from 5 to 16 percent. The areas are irregular or oval and range from 200 to 300 acres.

Keese soils make up an average of about 55 percent of the association but range from 45 to 70 percent of each mapped area. Rock outcrop of granite makes up an average of about 35 percent of the association but ranges from 20 to 45 percent of each mapped area. The rest of the association is small areas of Voca soils near drainageways and circular areas of Click soils. The included soils make up 10 to 20 percent of each mapped area.

Typically, the Keese soils have a surface layer of friable, light yellowish brown gravelly sandy loam 9 inches thick. At a depth of 9 to 17 inches is friable, strong brown gravelly sandy loam that has 25 percent by volume feldspar and quartz pebbles. The underlying material is indurated, granite bedrock (fig. 10). Reaction is slightly acid.

These soils are well drained. Runoff is rapid. Permeability is moderately rapid, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

Rock outcrops consist of granite boulders 2 to 3 feet high and 2 to 10 feet across. These boulders are in roughly circular spots and patches that range from 0.1 to 1.5 acres. In places, the outcrops are flat, oval, or circular exposures of granite that range from 3 to more than 60 feet across. These exposures are level to, or as much as 1 foot higher than the surface. In other places, pinnacles of outcrops rise to a height of 20 feet. These outcrops, which are irregular and sporadic in pattern, range from 1 to 25 acres and make up 20 to 30 percent of some areas.

The soils in this association are not suited to cultivated crops or tame pasture. Rock outcrops, shallow rooting depth, slope, and low available water capacity are limitations.

These soils are used mainly for range; however, they have low potential for native range plants. The range is a post oak-live oak savannah. There is about 20 percent oak overstory. An abundance of forbs and some woody shrubs and vines, including juniper, Texas persimmon, whitebrush, and mesquite, grow on this soil. Dominant grasses are little bluestem, sand lovegrass, sideoats grama, and green sprangletop.

These soils have low potential for wildlife habitat. The areas, however, are used by deer, dove, quail, and turkey. Several woody plants, forbs, and grasses that grow on this soil provide good cover, browse, fruits, and seeds for game birds and animals.

The soils in this association have medium potential for most recreational uses and low potential for most urban uses. Shallow depth to granite bedrock, moderately rapid permeability, slope, and rockiness are limitations.

Keese soils are in capability subclass VIIs and Shallow Gneiss range site. Rock outcrop is not assigned to a Capability subclass or a range site.

24—Krum clay, 1 to 3 percent slopes. This deep, gently sloping soil is in areas at the bases of limestone hills. Slopes are smooth to concave. The areas are long and narrow and range from 23 to 80 acres. Most areas are dissected by a U-shaped intermittent spring-fed drainage channel that is 2 to 8 feet deep and 4 to 12 feet wide.

Typically, the surface layer is firm, very dark grayish brown clay about 11 inches thick. At a depth of 11 to 17 inches is firm, dark grayish brown clay. The next layer at a depth of 17 to 56 inches is firm, brown clay that has soft bodies of calcium carbonate and a few small limestone fragments. Below this, extending to a depth of 72 inches, is firm, brown clay that contains soft bodies of calcium carbonate (fig. 11). Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and available water capacity is high. The root zone is deep; clay content, however, tends to impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Bolar and Doss soils. Also included are small areas of a soil that is wet most of the year. These areas are long

and oval and range from 2 to 4 acres. The inclusions make up less than 15 percent of the map unit.

This soil has high potential for cultivated crops and tame pasture. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming and terraces are needed in most areas to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has high potential for native range plants. Production of tall and midgrasses is good in favorable years. The range is tall grass prairie. Elm and hackberry trees grow along small streams, and single live oak trees and live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, limits use by deer and quail.

This soil has medium potential for recreational uses. The clayey surface layer and moderately slow permeability are limitations.

This soil has medium potential for most urban uses. Shrinking and swelling when there are changes in moisture content, low strength, caving of cutbanks, and high corrosivity to uncoated steel are limitations. Most of these limitations can be overcome by good design and careful installation procedures. Because the clayey subsoil restricts permeability, septic tank absorption fields require a special design on this soil.

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

25—Krum clay, 3 to 5 percent slopes. This deep, gently sloping soil is on foot slopes of limestone hills. Slopes are concave. The areas are long and narrow, and range from 30 to 110 acres. Most areas are intersected by a U-shaped, intermittent, spring-fed drainage channel that is 2 to 12 feet deep and 10 to as much as 60 feet wide.

Typically, the surface layer is very firm, very dark grayish brown clay about 13 inches thick. At a depth of 13 to 27 inches is very firm, dark grayish brown clay. The next layer at a depth of 27 to 39 inches is very firm, brown clay that has films, threads, soft bodies, and concretions of calcium carbonate. Below this, extending to a depth of 72 inches, is very firm, light brown clay that contains more threads and films of calcium carbonate than the upper layer and has small fragments of limestone.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high. The root zone is deep; the high clay content, however, tends to impede the movement of air, water, and roots. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Bolar, Doss, and Brackett soils. Also included are small areas of a soil that is wet most of the year. These areas are long and narrow and range from 1 to 4 acres. The inclusions make up less than 15 percent of the map unit.

This soil has high potential for cultivated crops and tame pasture. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the main crops. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming and terraces are needed in most areas to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has high potential for native range plants. Production of tall and midgrasses is good in favorable years. The range is tall grass prairie. Elm and hackberry trees grow along small streams, and single live oak trees or live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover limits use by deer and quail.

This soil has medium potential for most urban uses. Shrinking and swelling when there are changes in moisture content, low strength, caving of cutbanks, and high corrosivity to uncoated steel are limitations. Most of these limitations can be overcome by good design and careful installation procedures. Because the clayey underlying layer of this soil restricts permeability, septic tank absorption fields require a special design on this soil.

Potential of this soil for recreational uses is medium also. The clayey surface layer and moderately slow permeability are the most limiting features.

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

26—Lewisville clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on terraces near flood plains of streams. Slopes are smooth or slightly concave. The areas are long and oval or long and narrow and range from 30 to 60 acres.

Typically, the surface layer is firm, brown clay loam 16 inches thick. At a depth of 16 to 33 inches is firm, brown clay loam that has concretions and threads of calcium carbonate, and at a depth of 33 to 64 inches is firm, light brown clay loam that has many soft bodies, concretions, and threads of calcium carbonate. Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep, and air, water, and roots move through the soil easily. This soil receives additional water from surrounding higher lying areas. The hazard of water erosion is none to slight.

Included with this soil in mapping are small areas of Karnes, Oakalla, and Doss soils. They make up less than 10 percent of the map unit.

This soil is used for cultivated crops and range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the main crops.

The soil has high potential for cultivated crops and tame pasture. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. The soil needs to be tilled when moisture content is low. It responds to application of fertilizer.

This soil has high potential for native range plants. In favorable years, production of tall and midgrasses is excellent. The range is tall grass prairie; however, elm and hackberry grow along small streams, and single live oak trees and live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, is a limitation for deer and quail.

This soil has medium potential for recreational uses. The clay loam surface layer is a limitation.

This soil has medium potential for most urban uses. Shrinking and swelling when there are changes in moisture content and corrosivity to uncoated steel are limitations. Because the underlying layer of clay loam somewhat restricts permeability, septic tank absorption fields need to be increased in size or modified in design.

This soil is in capability class I and Clay Loam range site.

27—Lewisville clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on terraces and foot slopes near the flood plains of streams. Slopes are slightly concave. The areas are long and oval and range from 20 to 75 acres.

Typically, the surface layer is firm, dark grayish brown clay loam about 18 inches thick. At a depth of 18 to 58 inches is firm, light yellowish brown clay loam that has soft and cemented bodies of calcium carbonate. Below this, extending to a depth of 63 inches, is firm, light yellowish brown clay loam that has threads, films, and soft and cemented bodies of calcium carbonate. Reaction is moderately alkaline.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep, and air, water, and roots move through the soil easily. This soil receives additional water from surrounding higher lying areas. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Doss and Bolar soils. Also included are a few small areas of a soil that is similar to Lewisville soil that has a light colored surface layer. The inclusions make up 10 to 15 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the main crops.

This soil has high potential for cultivated crops and tame pasture. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. The soil needs to be tilled when the moisture content is low.

This soil has high potential for native range plants. Production of tall and midgrasses is excellent in favorable years. The range is tall grass prairie. Elm and hackberry trees grow along small streams, and single live oak trees or live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, limits use by deer and quail.

This soil has medium potential for recreational uses. The clay loam surface layer is a limitation.

This soil has medium potential for most urban uses. Shrinking and swelling when there are changes in moisture content and corrosivity to uncoated steel are limitations. Because the clay loam underlying layer somewhat restricts permeability, septic tank absorption fields need to be increased in size or modified in design.

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

28—Ligon-Rock outcrop association, undulating. This association consists of shallow, loamy soils and Rock outcrop on undulating uplands. Slopes are convex and range from 1 to 8 percent. The areas are irregular and range from 160 to 1,050 acres.

Ligon soils make up 60 to 75 percent of this association; Katemcy soils, about 10 to 25 percent; and Rock outcrop; about 15 percent. Small areas of Eckert, Keese, and Voca soils make up about 10 to 25 percent.

Typically, the Ligon soils have a surface layer of friable, reddish brown clay loam about 4 inches thick. At a depth of 4 to 15 inches is friable, dark red clay loam. Below this to a depth of 21 inches is weathered schist. The underlying material is cemented, fractured, weathered schist (fig. 12). Reaction is neutral.

These soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. Seeps along the

veins of schist are common after periods of high rainfall. The hazard of water erosion is moderate.

The rock outcrops are made up of dikes of long, narrow outcroppings of quartz. These outcrops are 1 to 5 acres. Schist and quartz pebbles are commonly on the surface around the outcrops.

The soils in this association have low potential for cultivated crops and tame pasture. Shallow rooting depth, schist outcrop, and very low available water capacity are the limitations.

These soils are used mainly for range. They have medium potential for range plants. Medium runoff, very low available water capacity, and shallow rooting depth limit the amount of forage production in favorable years. The range is mainly grassland that has a few scattered live oak trees, mid and short grasses, forbs, and a few small shrubs. Dominant vegetation is Texas wintergrass, fall switchgrass, buffalograss, hairy tridens, threeawns, prairie coneflower, Texas persimmon, and whitebrush.

These soils have medium potential for wildlife habitat. The areas are used by deer, turkey, dove, quail, and several species of nongame birds and small animals.

The soils in this association have medium potential for recreational uses and low to medium potential for most urban uses. Depth to rock, corrosivity to uncoated steel, low strength, and a clay loam surface are limitations.

Ligon soils are in capability subclass IVs and Schist range site. Rock outcrop is not assigned to a capability subclass or a range site.

29—Luckenbach clay loam, 1 to 3 percent slopes. This is a deep, gently sloping soil. Slopes are convex. The areas are irregular and range from 20 to 45 acres.

Typically, the surface layer is firm, dark reddish gray clay loam about 17 inches thick. At a depth of 17 to 25 inches is firm, dark brown clay loam. The next layer at a depth of 25 to 36 inches is firm, reddish brown clay that has calcium carbonate concretions in the lower part. Below this, extending to a depth of 80 inches, is friable, clay loam. It is reddish yellow in the upper part and very pale brown in the lower part that contains many hard and soft bodies of calcium carbonate. Reaction is moderately alkaline.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is medium. The root zone is moderately deep; clay content, however, tends to impede movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Bolar, Lewisville, and Pedernales soils. The inclusions make up less than 10 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the main crops.

This soil has high potential for cultivated crops and tame pasture. Use of crop residue helps prevent water erosion, conserve moisture, improve soil tilth, and increase water intake. This soil has good tilth if it is cultivated at low moisture content. Contour farming and terraces are needed in most areas to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is good in favorable years. The range is tall grass prairie. Elm and hackberry trees grow along small streams, and single live oak trees or live oak motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover, however, limits use by deer and quail.

This soil has medium potential for recreational uses. The clayey surface layer and moderately slow permeability are limitations.

This soil has medium potential for most urban uses. Moderate shrinking and swelling when there are changes in moisture content, corrosivity to uncoated steel, and a clayey texture are limitations. Most of these limitations can be overcome by good design and careful installation procedures. Because the clayey underlying layer restricts permeability, septic tank absorption fields require special design.

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

30—Nebgen-Oben-Rock outcrop association, rolling. This association consists of shallow, stony, and loamy soils and Rock outcrop on rolling uplands. Slopes are convex and range from 5 to 16 percent. Areas are irregular or long and oval and range from 200 to 800 acres.

Nebgen soils make up an average of 50 percent of the association but range from 20 to 70 percent of each mapped area. Oben soils average 25 percent of the association but range from 10 to 60 percent of each mapped area. Rock outcrop makes up an average of about 15 percent of the association but ranges from 10 to 30 percent. Other soils, steep areas of Nebgen and Oben soils and areas of Hye soils make up about 10 to 20 percent of the association.

Typically, Nebgen soils have a surface layer of very friable, reddish brown fine sandy loam about 14 inches thick. It has 10 percent by volume angular sandstone cobbles. At a depth of 14 to 19 inches is mixed reddish brown weathered sandstone and brown fine sandy loam. The underlying material is cemented sandstone plates (fig. 13). Reaction is neutral.

Nebgen soils are well drained. Runoff is rapid. Permeability is moderately rapid, and available water capacity is

very low. The root zone is shallow. Seeps along the top of the sandstone bedrock are common after periods of heavy rainfall. The hazard of water erosion is severe.

Typically, Oben soils have a surface layer of very friable, brown stony sandy loam about 7 inches thick. From 7 to 15 inches is friable, reddish brown sandy clay that has sandstone plates of cobble size. The underlying material is cemented sandstone plates. Reaction is neutral.

Oben soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The sandstone Rock outcrop, which is in a random pattern across the mapped area, projects 6 to 12 inches above the surface. The areas of outcrops are long and narrow or long and oval and are from 0.1 to 1.0 acre. In a few places, prominent sandstone boulders are 2 to as much as 6 feet high.

The soils in this association are used mainly for range. They are not suited to cultivated crops and tame pasture. They have low potential for native range plants. Moderate to rapid runoff, very low available water capacity, and shallow rooting depth limit the amount of forage production in favorable years. The range is a post oak, blackjack oak, live oak savannah. Dominant grasses are little bluestem, sideoats grama, indiangrass, hooded windmillgrass, cane bluestem, and pinhole bluestem.

The soils have low potential for wildlife habitat. The areas are used by deer, turkey, quail, dove, and squirrel.

The soils in this association have medium potential for most recreational uses and low potential for most urban uses. Slope, Rock outcrop, and shallow depth to sandstone bedrock are limitations.

Nebgen soils are in capability subclass VIIs and Sandstone Hills range site. Oben soils are in capability subclass VIs and Red Sandy Loam range site. Rock outcrop is not assigned to a capability subclass or a range site.

31—Oakalla loam. This deep, nearly level soil is on flood plains of major streams. Slopes are smooth to slightly concave and range from 0 to 1 percent. Areas are long and oval or long and narrow and range from 20 to 250 acres.

Typically, the surface layer is very friable, dark grayish brown loam about 8 inches thick. At a depth of 8 to 22 inches is friable, dark grayish brown clay loam that has threads of calcium carbonate. The next layer at a depth of 22 to 56 inches is friable, brown clay loam that has many threads and films of calcium carbonate. Below this, extending to a depth of 63 inches is friable, light yellowish brown clay loam that has soft bodies of calcium carbonate. Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep. Air, water, and roots move through the soil easily. This soil receives additional water and floods about once every 2 to 8 years for a few hours. The hazard of water erosion is none to slight.

Included with this soil in mapping are small areas of Karnes soil, Oakalla silty clay loam, and small areas of a soil similar to Oakalla soil that has a dark surface layer less than 20 inches thick. The inclusions make up 16 to 20 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the principal crops.

This soil has high potential for cultivated crops and tame pasture. Use of crop residue helps to control water erosion, improve fertility, reduce crusting, increase water infiltration, and conserve moisture. It also helps to improve soil tilth and increase water intake. Because of the high content of lime, a yellowing of the leaves or iron chlorosis is a problem on this soil. The soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is good in favorable years. Cypress, pecan, elm, and oak trees commonly grow near the water; some trees, however, are away from the streams together with grasses and forbs. Shrubs occur as understory and in open land. Dominant grasses are big bluestem, indiangrass, eastern gamagrass, little bluestem, switchgrass, and broadleaf uniola.

This soil has high potential for wildlife habitat. The area is used by deer, squirrel, turkey, dove, quail, and other birds. Beaver, raccoon, fox, cottontail, and other animals also inhabit the area.

This soil has medium potential for most recreational uses. Flooding is a limitation.

This soil has low to medium potential for urban uses. Flooding, seepage, low strength, and corrosivity to uncoated steel are limitations.

This soil is in capability class I and Loamy Bottomland range site.

32—Oakalla silty clay loam. This deep, nearly level soil is on flood plains of major streams. Slopes are smooth to slightly concave and range from 0 to 1 percent. Areas are long and oval or long and narrow and range from 15 to 30 acres.

Typically, the surface layer is firm, very dark grayish brown silty clay loam 23 inches thick. At a depth of 23 to 60 inches is firm, brown silty clay loam. Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep. Air, water, and roots move through the soil easily. The hazard of water erosion is none to slight. This soil receives additional water and floods about once every 2 to 8 years for a few hours.

Included with this soil in mapping are small areas of Lewisville and Karnes soils, and Oakalla loam. The inclusions make up 5 to 15 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the principal crops.

This soil has high potential for cultivated crops and tame pasture. Use of crop residue helps to improve fertility, reduce crusting, control water erosion, increase water infiltration, and conserve moisture. It also helps to improve soil tilth and increase water intake. This soil needs to be tilled at low moisture content. Because of the high content of lime, yellowing of the leaves or iron chlorosis is a problem on this soil. The soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is good in favorable years. Cypress, pecan, elm, and oak trees commonly grow near water, but some trees are away from the stream in the savannah together with grasses and forbs. Shrubs occur as understory and in open land. Dominant grasses are big bluestem, indiangrass, eastern gamagrass, little bluestem, switchgrass, and broadleaf uniola.

This soil has high potential for wildlife habitat. The areas are used by deer, squirrel, turkey, dove, quail, and other birds. Beaver, raccoon, fox, cottontail, and other animals also inhabit this area.

This soil has medium potential for most recreational uses. The silty clay loam surface layer and flooding are limitations.

This soil has low to medium potential for urban uses. Flooding, seepage, low strength, and corrosivity to uncoated steel are limitations.

This soil is in capability class I and Loamy Bottomland range site.

33—Oben fine sandy loam, 1 to 5 percent slopes. This shallow, gently sloping soil is on convex ridges. Areas are irregular and range from 20 to 95 acres.

Typically, the surface layer is very friable, reddish brown fine sandy loam 6 inches thick. At a depth of 6 to 14 inches is very friable, reddish brown loam. The next layer at a depth of 14 to 19 inches is friable, reddish brown sandy clay loam that has a few sandstone fragments. The underlying material is plates of cemented sandstone. Reaction is neutral.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow. Air, water, and roots move through the soil easily. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Hye, Eckert, and Nebgen soils. Also included are small areas of a soil that is similar to Oben soil that has a sandy clay or clay subsoil. The inclusions make up 5 to 20 percent of the map unit.

This soil is used mostly for range. A few small areas are used for cultivated crops. Oats is the main crop.

This soil has low potential for cultivated crops and tame pasture. Shallow rooting depth and very low available water capacity are limitations. Use of crop residue helps control water erosion, conserve moisture, improve soil tilth, and increase water intake.

This soil has medium potential for native range plants. Production of tall and midgrasses is medium in favorable years. The range is a live oak-post oak savannah. Trees grow to relatively large size on this soil. Live oak is more abundant than post oak. Dominant grasses are little bluestem, sandhill lovegrass, sideoats grama, pinhole bluestem, hooded windmillgrass, plains lovegrass, and sandbur.

This soil has medium potential for wildlife habitat. The areas are used by deer, turkey, quail, dove, and several species of nongame birds and small animals.

This soil has high potential for recreational uses. However, because of shallow depth to rock, the potential is low for playgrounds.

This soil has low potential for most urban uses. Shallow depth to rock is a limitation. Cutting into cemented, fractured sandstone is a hazard if cuts or excavations exceed about 19 inches.

This soil is in capability subclass IVe and Red Sandy loam range site.

34—Owens association, hilly. This association consists of shallow, shaly, clayey soils on hills that have sharp ravines and gullies which extend into the valley below. Slopes are convex and range from 10 to 30 percent. Areas are irregular and range from 260 to 700 acres.

Owens soils make up 60 to 80 percent of the association. A soil that is similar to Owens soils but is slightly deeper to bedrock makes up 10 to 30 percent of each mapped area. The rest of the association is small areas of Brackett and Throck variant soils.

Typically, Owens soils have a surface layer of firm, pale olive clay about 4 inches thick. At a depth of 4 to 12 inches is firm, pale olive clay. Below this to a depth of 18 inches is very firm, olive clay that contains soft bodies and threads of calcium carbonate. The underlying material is pale olive platy shale. Reaction is moderately alkaline.

These soils are well drained. Runoff is rapid. Permeability is very slow, and available water capacity is very low. The root zone is shallow. Seeps are common after periods of high rainfall. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops or tame pasture. Shallow rooting depth, slope, and low available water capacity are limitations. These soils are used for range.

These soils have low potential for native range plants. Dominant grasses are sideoats grama, little bluestem, and Texas wintergrass. Also included are such woody brush species as whitebrush, elm, and hackberry.

These soils have low potential for wildlife habitat. The areas are used by dove, quail, deer, and turkey. Several forbs and grasses provide good cover, fruits, and seeds for game birds.

These soils have low potential for most recreational and urban uses. Slope, very slow permeability, high shrinking and swelling when there are changes in moisture content, a clayey texture, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIIs and Shallow Clay range site.

35—Pedernales fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil. Slopes are convex. Areas are circular or oblong and range from 20 to 50 acres.

Typically, the surface layer is very friable, reddish brown fine sandy loam about 11 inches thick. At a depth of 11 to 17 inches is very firm, red sandy clay. The next layer at a depth of 17 to 38 inches is very firm, red sandy clay. Below this, extending to a depth of 80 inches, is very firm, reddish yellow sandy clay (fig. 14). Reaction is neutral to a depth of 38 inches and moderately alkaline below.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high. The root zone is deep. Clay content, however, tends to impede movement of air, water, and roots. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Hensley and Heaton soils. The inclusions make up less than 15 percent of the map unit.

This soil is used for cultivated crops and for range.

This soil has medium potential for cultivated crops and tame pasture. Wheat, oats, grain sorghum, and peaches are the main crops. Peaches grow well on this soil. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming and grassed waterways provide good outlets for terrace systems if excess water is a problem. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of nutritious, palatable, tall and midgrasses is medium in favorable years. The range is mixed prairie grassland that has scattered live oak and a few post oak trees. Some elm and hackberry grow along drainageways. Dominant grasses are sideoats grama, little bluestem, hooded windmillgrass, Texas wintergrass, and switchgrass.

This soil has high potential for wildlife habitat. The areas are used by deer, quail, turkey, dove, and several species of nongame birds and small animals.

This soil has high to medium potential for recreational uses. Moderately slow permeability is a limitation.

This soil has medium potential for most urban uses. Shrinking and swelling of the lower layers when there are changes in moisture content, and low strength and corrosivity to uncoated steel are limitations. Most of these limitations can be overcome by good design and careful installation procedures.

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

36—Pedernales fine sandy loam, 3 to 5 percent slopes. This is a moderately deep, gently sloping soil. Slopes are convex. Areas are long and oval and range from 30 to 60 acres.

Typically, the surface layer is very friable, reddish brown fine sandy loam about 8 inches thick. At a depth of 8 to 24 inches is very firm, red sandy clay. The next layer at a depth of 24 to 36 inches is very firm, red sandy clay. The underlying material is plates of cemented caliche. Reaction is slightly acid to a depth of about 8 inches and neutral below.

This soil is well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is high. The root zone is moderately deep. Clay content tends to impede movement of air, water, and roots. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Hensley, Doss, and Heaton soils. The inclusions make up 6 to 17 percent of the map unit.

This soil is used for cultivated crops and for range.

This soil has medium potential for cultivated crops and tame pasture. Wheat, oats, grain sorghum, and peaches are the main crops. Peaches grow well on this soil. Use of crop residue helps control water erosion, conserve moisture, improve soil tilth, and increase water intake. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of nutritious, palatable tall and midgrasses is medium in favorable years. The range is mixed prairie grassland that has scattered live oak and a few post oak trees. Some elm and hackberry are along drainageways. Dominant grasses are sideoats grama, little bluestem, hooded windmillgrass, Texas wintergrass, and switchgrass.

This soil has high potential for wildlife habitat. The areas are used by deer, quail, turkey, dove, and several species of nongame birds and small animals.

This soil has high to medium potential for some recreational uses. Moderately slow permeability is a limitation.

This soil has medium potential for most urban uses. Shrinking and swelling of the lower layers when there are changes in moisture content, and low strength and corrosivity to uncoated steel are limitations. Most of these limitations can be overcome by good design and installation procedures.

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

37—Purves gravelly clay, 1 to 3 percent slopes. This shallow, gently sloping soil is underlain by limestone. Slopes are convex. The areas are irregular or long and oval and range from 40 to 160 acres.

Typically, the surface layer is friable, very dark grayish brown gravelly clay 7 inches thick. At a depth of 7 to 14 inches is friable, very dark grayish brown, very gravelly clay. The underlying material is indurated limestone bedrock (fig. 15). Reaction is moderately alkaline.

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

Included with this soil in mapping are small areas of Doss, Brackett, and Bolar soils. The inclusions make up less than 15 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, wheat, tame pasture, and grass for hay are the principal crops.

This soil has medium potential for cultivated crops and tame pasture. Shallow rooting depth and very low available water capacity are limitations. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming and terraces are needed in some areas to control water erosion. Grassed waterways provide good outlets for terrace systems if excess water is a problem. Cutting into indurated limestone bedrock is a hazard if cuts or excavations exceed about 14 inches. This soil responds to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is medium in favorable years. The range is an open grassland of midgrasses that has scattered live oak motts. Dominant grasses are little bluestem, sideoats grama, pinhole bluestem, buffalograss, and threeawns.

This soil has low potential for wildlife habitat. The areas are used by deer, turkey, dove, quail, and other birds. Several plants that grow on this soil provide good cover, browse, fruits, and seeds for game birds and animals.

This soil has low potential for most recreational and urban uses. Depth to rock, a clayey texture, and corrosivity to uncoated steel are limitations.

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

38—Purves association, undulating. This association consists of shallow, stony soils that are underlain by limestone. Slopes are convex and range from 1 to 8 percent. Areas are irregular and range from 60 to 300 acres.

Purves soils make up 60 to 80 percent of each mapped area. Doss soils make up an average of about 15 percent of the association but range from 5 to 20 percent of each mapped area. Brackett soils make up about 10 percent of some mapped areas. The rest of the association is small areas of Bolar and Tarpley soils and narrow outcropping bands of limestone and marl in places.

Typically, the Purves soils have a surface layer of firm, very dark grayish brown stony clay about 9 inches thick. At a depth of 9 to 16 inches is firm, brown cobbly clay. The underlying material is indurated, fractured limestone bedrock. Reaction is moderately alkaline.

These soils are well drained. Surface runoff is medium. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops or tame pasture. A stony surface, shallow rooting depth, and very low available water capacity are limitations.

These soils are used mainly for range. They have medium potential for native range plants; however, medium runoff, very low available water capacity, and restricted rooting depth limit the amount of forage production even in favorable years. The range is an open grassland of midgrasses and scattered live oak motts. Dominant grasses are little bluestem, sideoats grama, pinhole bluestem, buffalograss, and threeawns.

These soils have medium potential for wildlife habitat. The areas are used by deer, turkey, dove, quail, and other birds. Several plants provide good cover, browse, fruits, and seeds for game birds and animals in favorable years.

The soils in this association have low potential for most recreational and urban uses. Slope, depth to rock, a clayey texture, and corrosivity to uncoated steel are limitations.

This association is in capability subclass VIs and Shallow range site.

39—Renick stony clay loam, 5 to 12 percent slopes. This shallow, strongly sloping soil is on long narrow ridges that have outcrops of serpentine. Slopes are convex. The area is irregular in shape and 735 acres in size. The outcrops, which are a few inches to as much as 18 inches above the surface, are wedge-shaped and follow the contour of the slope in rows. They are tilted 30 degrees from horizontal. Stones cover 10 to 20 percent of the surface.

Typically, the surface layer is firm, very dark grayish brown clay loam about 6 inches thick. At a depth of 6 to 14 inches is firm, very dark grayish brown clay loam that has angular serpentine pebbles. The next layer at a depth of 14 to 18 inches is very firm, dark grayish brown clay that has angular serpentine pebbles. The underlying material is light olive gray indurated serpentine bedrock. Reaction is neutral.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is

low. The root zone is shallow. The hazard of water erosion is severe.

Included with this soil in mapping are long narrow areas of Ligon soil and crescent-shaped areas of a soil that is similar to Renick soil that has bedrock at a depth of more than 20 inches. Also included are areas of serpentine rock in lateral distances ranging from 3 to about 30 feet. The inclusions make up less than 15 percent of the map unit.

This soil is not suitable for cultivated crops or tame pasture. Shallow depth, slopes, rock outcrop, and low available water capacity are limitations. The soil is used for range.

This soil has low potential for plants. Dominant grasses are hairy grama, curlymesquite, and little bluestem. Live oak trees grow on the soil.

This soil has low potential for wildlife habitat. The areas, however, are used by deer, turkey, quail, rabbit, and dove.

This soil has low potential for most recreational and urban uses. Shrinking and swelling when there are changes in moisture content, depth to rock, stoniness, and slope are limitations.

This soil is in capability subclass VIIs and Serpentine Hills range site.

40—Spicewood-Rock outcrop association, gently undulating. This association consists of moderately deep, cobbly, loamy soils and Rock outcrop on low, stony hills. Slopes are convex and range from 1 to 5 percent. The areas are irregular and range from 400 to 600 acres.

Spicewood soil averages about 60 percent of the association, but ranges from 50 to about 65 percent. A soil similar to Spicewood soil that has bedrock at a depth of less than 25 inches makes up 5 to 20 percent of some mapped areas. Limestone Rock outcrop, which is in all mapped areas, makes up an average of 15 percent of the association. Also included are areas of Hensley, Pedenales, and Tarpley soils which make up about 15 percent of the association.

Typically, the Spicewood soil has a surface layer of very firm, dark reddish brown cobbly clay loam about 8 inches thick. It has 30 percent angular limestone cobbles. At a depth of 8 to 22 inches is very firm, dusky red very cobbly clay that contains 60 percent angular limestone cobbles. Below this to a depth of 38 inches is extremely firm, dark red clay. The underlying material is porous limestone and black dolomite (fig. 16). Reaction is neutral.

These soils are well drained. Runoff is medium. Permeability is slow, and available water capacity is low. The root zone is moderately deep. The hazard of water erosion is severe.

Rock outcrop is an exposure of limestone bedrock in long, narrow, or crescent-shaped areas. Limestone pebbles and cobbles cover from 5 to 20 percent of the surface around these outcrops.

The soils in this association are not suited to cultivated crops or tame pasture. Cobbles on the surface and Rock outcrop are limitations.

These soils are used for range. They have medium potential for native range plants. The range is an oak savannah. Dominant grasses are little bluestem, indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

These soils have medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruits, and seeds for wildlife.

The soils in this association have medium potential for recreational uses and low potential for most urban uses. Depth to rock, slow permeability, limestone fragments, a cobbly clay loam surface texture, and corrosivity to uncoated steel are limitations.

Spicewood soil is in capability subclass VIs and Redland range site. Rock outcrop is not assigned to a capability subclass or a range site.

41—Tarpley clay, 1 to 3 percent slopes. This is a gently sloping, shallow soil. Slopes are convex. Areas are roughly circular and range from 45 to 125 acres.

Typically, the surface layer is very firm, dark reddish gray clay about 8 inches thick. At a depth of 8 to 15 inches is very firm, reddish brown clay. The underlying material is indurated limestone bedrock (fig. 17). Reaction is neutral.

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

Included with this soil in mapping are small irregular areas of Anhalt soil, circular areas of Doss soil, and a few exposures of bedrock that are 1 to 3 feet across. The inclusions make up less than 10 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum and oats are the main crops.

This soil has medium potential for cultivated crops and tame pasture. Grain sorghum and oats are the principal crops. Shallow rooting depth and low available water capacity are limitations. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. Contour farming is needed in most areas to control water erosion. If cuts or excavations exceed 15 inches, cutting into limestone bedrock is a hazard.

This soil has medium potential for native range plants. Production of nutritious mid- and tall grasses is high in favorable years. The range is an oak savannah. There is about 20 percent tree shade consisting mainly of live

oak and post oak, together with blackjack oak and Texas oak in some areas. Dominant grasses are little bluestem, indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruits, and seeds for wildlife.

This soil has low potential for recreational uses. Depth to rock and a clayey texture are limitations that are difficult to overcome.

This soil has low potential for most urban uses. Depth to rock, corrosivity to uncoated steel, and shrinking and swelling when there are changes in moisture content are limitations.

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

42—Tarpley association, undulating. This association is on uplands. It is made up of shallow, stony, clayey soils that are underlain by limestone. Slopes are convex and range from 1 to 8 percent. Areas are irregular and range from 50 to 350 acres. Outcrops of limestone are in long, narrow, irregular ledges that are 12 to 60 feet wide, and in random spots and patches 3 to 10 feet across. Some outcrops are level with the surface, and some rise to a height of as much as 30 inches higher than the surface.

Tarpley soils make up an average of about 65 percent of the association but range from 50 to 70 percent of each mapped area. Limestone outcrops range from 5 to 20 percent of the association. Eckrant soils are in 30 percent of the mapped areas and average about 25 percent of each area in which they occur. Crescent-shaped areas of Anhalt and Pedernales soils and a few small oval-shaped areas of Tarpley clay loam make up as much as 15 percent of each mapped area. Besides stones, the surface is covered with 10 to 15 percent limestone pebbles and cobbles.

Typically, the Tarpley soils have a surface layer that is very firm, dark reddish gray stony clay about 8 inches thick. At a depth of 8 to 15 inches is very firm, reddish brown clay. The underlying material is fractured limestone bedrock. Reaction is neutral.

These soils are well drained. Runoff is medium. Permeability is slow, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is severe.

The soils in this association are not suited to cultivated crops or tame pasture. Stoniness, shallow rooting depth, and low available water capacity are limitations.

These soils are used for range. They have medium potential for native range plants. Production of nutritious mid and tall grasses is high in favorable years. The range is an oak savannah. There is about 20 percent live oak and post oak overstory that includes blackjack oak and Texas oak in places. Dominant grasses are little bluestem, indiangrass, big bluestem, Canada and Virginia wildrye, sideoats grama, Texas wintergrass, vine-mesquite, tall dropseed, feathery bluestem, plains lovegrass, Texas cupgrass, and buffalograss.

These soils have medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Several woody plants, forbs, and grasses provide cover, browse, fruits, and seeds for wildlife.

These soils have low potential for recreational uses. Depth to rock, slope, stoniness, and a clayey texture are limitations that are difficult to overcome.

The soils in this association have low potential for most urban uses. Depth to rock, corrosivity to uncoated steel, and shrinking and swelling when there are changes in moisture content are limitations.

This association is in capability subclass VIs and Redland range site.

43—Throck Variant silty clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is at the bases of shaly hills. Slopes are concave. Areas are irregular and range from 15 to 40 acres.

Typically, the surface layer is firm, yellowish brown silty clay loam 8 inches thick. At a depth of 8 to 17 inches is friable, grayish brown silty clay loam. The next layer at a depth of 17 to 32 inches is friable, light olive brown silty clay loam that has a few soft bodies of calcium carbonate. Below this at a depth of 32 to 41 inches is friable, light yellowish brown silty clay loam that has numerous films, threads, and soft bodies of calcium carbonate. Underlying this, and extending to a depth of 80 inches, is firm, light yellowish brown sandy clay loam. Reaction is moderately alkaline.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is high. The root zone is deep. Air, water, and roots move easily through the soil. This soil receives additional water from the surrounding higher landscape. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Owens and Oakalla soils. The inclusions make up from 5 to 15 percent of the map unit.

This soil is used for cultivated crops and for range. Oats and grass for hay are the main crops.

This soil has medium potential for cultivated crops and for tame pasture. Use of crop residue helps to control water erosion, conserve moisture, improve soil tilth, and increase water intake. This soil responds well to application of fertilizer. Nitrogen and phosphorus are needed.

This soil has medium potential for native range plants. Production of tall and midgrasses is medium in favorable years. The range is tall grass prairie. Elm and hackberry trees grow along small streams, and live oak trees or motts are widely spaced throughout. Dominant grasses are little bluestem, indiangrass, big bluestem, sideoats

grama, Texas wintergrass, Texas cupgrass, cane and pinhole bluestem, vine-mesquite, and tall dropseed.

This soil has medium potential for wildlife habitat. The areas are used by deer, dove, and quail. Lack of cover limits use by deer and quail.

This soil has medium potential for recreational uses. The silty clay loam surface layer and slow permeability are limitations.

This soil has low to medium potential for urban uses. Shrinking and swelling when there are changes in moisture content and corrosivity to uncoated steel are limitations. Most of these limitations, however, can be overcome by good design and careful installation procedures. Because the lower layer of this soil restricts permeability, use for septic tank absorption fields is limited; the absorption area needs to be increased in size or modified in design.

This association is in capability subclass IIIe and Shallow Clay range site.

44—Voca association, gently undulating. This association consists of deep, loamy and gravelly soils. Slopes are convex and range from 1 to 5 percent. Areas are roughly circular, long and oval, or irregular and range from 250 to 1,950 acres. Spots of roughly circular granite outcrop as much as 2 acres in size and 10 feet high occur.

Voca soil makes up 50 to 100 percent of each mapped area, Click soil makes up 0 to 40 percent, and Keese soil makes up 0 to 20 percent. Small oval or crescent-shaped areas of Hye soil, narrow areas of Oben soil on ridges, and granite outcrops make up 10 to 20 percent of each mapped area.

Typically, the Voca soil has a surface layer of very friable, brown gravelly sandy loam about 8 inches thick. At a depth of 8 to 19 inches is very firm, dark reddish brown gravelly clay. The next layer at a depth of 19 to 28 inches is very firm, yellowish red gravelly clay. Below this to a depth of 48 inches is very firm, red very gravelly clay. The underlying material is weathered and fragmented granite (fig. 18). Reaction is neutral to a depth of 8 inches and slightly acid below.

These soils are well drained. Runoff is medium. Permeability is slow, and available water capacity is low. The root zone is deep; however, clay content tends to impede the movement of air, water, and roots. The hazard of water erosion is moderate.

The soils in this association have low potential for cultivated crops and tame pasture. A few small areas are cultivated. Grain sorghum, oats, and tame pasture are the principal crops. Keeping crop residue on or near the surface helps control water erosion, conserve moisture, and improve soil tilth and water intake. This soil responds to the use of fertilizer. Nitrogen and phosphorus are needed.

These soils are used mostly for range; however, they have low potential for native plants. The range is an open savannah of post oak, blackjack oak, and live oak. Dominant grasses are little bluestem, sideoats grama, hairy grama, Arizona cottontop, and sandhill lovegrass. Production of tall and midgrasses in favorable years is fair.

These soils have low potential for wildlife habitat. The area is used by deer, quail, squirrel, dove, and several species of nongame birds and small animals.

These soils have medium potential for recreational uses. Slope, small stones, and slow permeability are limitations.

The soils in this association have medium potential for most urban uses. Shrinking and swelling when there are changes in moisture content, corrosivity to uncoated steel, and depth to bedrock are limitations. However, most of these limitations can be overcome by good design and careful installation procedures.

This association is in capability subclass IVs and Granite Gravel range site.

45—Weswood silt loam. This deep, nearly level soil is on slightly convex flood plains of the Colorado and Lampasas Rivers. Slopes are from 0 to 1 percent. Areas are long and narrow and range from 12 to 40 acres.

Typically, the surface layer is friable, brown silt loam about 7 inches thick. At a depth of 7 to 30 inches is friable, brown silt loam that has fine roots, worm casts, and threads and films of calcium carbonate. The next layer at a depth of 30 to 48 inches is friable, brown silt loam that has a few thin strata of very fine sandy loam. Below this, extending to a depth of 63 inches, is friable, reddish yellow silt loam that has thin strata of fine sandy loam. Reaction is moderately alkaline.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. The hazard of water erosion is slight. This soil floods on rare occasions.

Included with this soil in mapping are a few long, narrow areas of Oakalla soil and areas of a Weswood soil that has a sandy loam or loam surface layer 3 to 6 inches thick. The included soils make up as much as 20 percent of the map unit.

This soil is used for cultivated crops and for range. Grain sorghum, oats, and wheat are the principal crops.

This soil has high potential for cultivated crops and tame pasture.

This soil has medium potential for native plants. Production of tall and midgrasses is medium in favorable years. The range is a savannah that has grasses, forbs, and trees. Cypress, pecan, elm, and oak trees grow near streams. Shrubs occur as understory and in open land. Dominant grasses are big bluestem, indiangrass, eastern gamagrass, little bluestem, switchgrass, and broadleaf uniola.

This soil has medium potential for wildlife habitat. The areas are used by deer, squirrel, turkey, dove, quail, and

other birds. Beaver, raccoon, fox, cottontail, and other animals also use this area.

This soil has medium potential for recreational uses. Dust is a limitation.

This soil has low potential for urban uses because of flooding.

This soil is in capability subclass IIc and Loamy Bottomland 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 tank disposal 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 crops and pasture, and rangeland as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for 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 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.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, 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." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

According to the Conservation Needs Inventory (*3*) in 1967, 68,674 acres in Blanco and Burnet Counties was in cultivated crops and 3,525 acres was in pasture crops. Grain sorghum, wheat, and oats, were the principal crops. Some acreage that was formerly cropped had been returned to open land.

These soils have good potential for increased production of food. Production could be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1967 there were about 20,532 acres in cities, towns, and communities in the survey area, and this figure has been growing at the rate of about 850 acres per year. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major concern on the cropland and pastureland. If slope is more than 1 percent, erosion is a hazard. Bolar, Doss, Heaton, Krum, and Pedernales soils, for example, have slopes of 1 to 5 percent.

Loss of the surface layer through erosion 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 that have a clayey subsoil, for example, the Luckenbach and Pedernales soils. It is also damaging on soils in which the root zone is limited because of a pan in or below the subsoil, or because of shallow depth to bedrock, as, for example, in the Tarpley

and Purves soils. Because such soils as Voca gravelly sandy loam and Hye soil tend to be droughty, loss of the surface layer reduces productivity on these soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal and recreational uses, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the grass forage crops in the cropping system reduce erosion on sloping land, and improve tilth for the following crop.

Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area. No-tillage for grain sorghum is effective in reducing erosion on sloping land and can be adapted to most soils in the survey area. It is more difficult to practice successfully, however, on soils that have a clayey surface layer.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are not practical on deep, well drained soils that have regular slopes. Bolar soils and Krum soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of a clayey subsoil which would be exposed in terrace channels, or because of bedrock at a depth of less than 20 inches.

Contouring is an effective method of controlling erosion. It is a suitable practice on soils that have smooth, uniform slopes, for example, in most areas of the sloping Bolar, Doss, Hensley, Krum, and Lewisville 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 fertility is naturally low in most soils on uplands in the survey area. In soils on flood plains, for example, Weswood and Oakalla soils, plant nutrients are naturally higher than in most soils on uplands.

On all soils additions of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer to apply.

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

Most soils used for crops in the survey area have a clay or clay loam surface layer that is low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry and nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help to improve soil structure and reduce crust formation.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Grain sorghum is the main row crop (fig. 19). Wheat and oats are common close growing crops.

Special crops are grown commercially on a small scale. Peaches and apples are the most important fruit trees. Melons, sweet corn, tomatoes, peppers, and other vegetables and small fruits are also grown.

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

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. 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 and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

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.

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 4 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.

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 rice, cranberries, 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 rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. No class V soils are in Blanco and Burnet Counties.

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. No class VIII soils are in Blanco and Burnet Counties.

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, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 5. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

Pasture and hay crops

The selection of grasses that are suited to the soil is the foremost consideration in developing a pasture. Consideration also needs to be given to the feasibility of developing a year-long forage program that uses a combination of forage species. Such a program could use both warm and cool season grasses for grazing during their season of growth; for example, improved bermudagrass forage could be provided from May to November, and weeping lovegrass, King Ranch bluestem or Kleingrass forage, from November to May. Or, if preferred, the warm season species could be field cured for use in winter. If pasture is to be used together with range, improved bermudagrass could be grazed in the warm season and field cured native grasses and protein supplement used in winter.

Several applications of fertilizer throughout the growing season help to increase the amount of high quality forage. To sustain high production, application of fertilizer, weed control, and regulation of grazing are needed.

The need for fertilizer varies among different groups of soils, depending mostly upon past use of the soil, the amount of erosion that has taken place, and the texture of the soils. All soils generally benefit from application of nitrogen and phosphorus; however, most soils except some that are sandy or shallow loamy, have enough potash. The kind and amount of fertilizer needed for the type of plant selected and the desired production of that plant need to be determined by a chemical soil test. Fertilizer can be applied and incorporated into the soil by disking two or three weeks before grasses are sprigged or seeded. Control of weeds by mowing reduces compe-

tition for moisture and plant nutrients and increases the growing space for desirable grasses.

Grazing needs to be regulated. Proper distribution of livestock water and rotation of grazing among several pastures helps to avoid undergrazing or overgrazing. For better management of grazing, only one grass species should be planted in a pasture.

To maintain vigorous plants that sustain high production, grasses should not be grazed too short. The quick regrowth of grass species after grazing and the amount of forage these species provide depend on the amount of foliage left. For example, on King Ranch bluestem or coastal bermudagrass, a stubble height of 6 inches should be maintained to obtain a quick, vigorous regrowth. On common bermudagrass, however, a height of 4 inches is sufficient to provide for quick regrowth.

Supplementary grazing crops, for example, sudan grass and small grain are often grown on soils used for crops to provide seasonal forage and to avoid overgrazing the permanent pasture. Grazing needs to be restricted on wet soils to prevent compaction of the surface.

Rangeland

Range is the main renewable natural resource, and the raising of livestock is the major enterprise in Blanco and Burnet Counties. About 999,770 acres, or approximately 90 percent of the survey area is in native range. Cattle, sheep, and angora goats are grazed throughout the survey area. Deer and wild turkey use the range for food and cover. In many places, recreation and hunting are profitable enterprises.

The soils on the limestone hills produce live oak, shin oak, and other browse plants, together with grasses and forbs. This area is well suited to grazing by sheep, goats, and cattle. The deeper soils in the valleys and lower lying plains produce a true prairie of mid and tall grasses intermixed with some forbs and woody plants; those soils in the northeastern part of the survey area produce mid and tall grasses and a few motts of live oak and pecan trees along the streams; and the soils weathered from sandstone and granite produce tall grasses, forbs, and post oak trees.

On all soils, the number of livestock grazed needs to be kept in balance with forage production. The amount of forage fluctuates according to seasonal annual changes in rainfall. In dry years, cover deteriorates and the amount of forage produced greatly decreases. Seasonal rainfall varies. Rainfall in spring and early in summer is critical because 60 to 70 percent of the total forage crop is produced during this period. Rainfall in August, September, and October is followed by another period of growth. If rainfall in winter is favorable, the deep, more fertile soils produce some grasses and forbs that grow late in winter and early in spring.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland 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 total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; 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 predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. Following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland 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, soil texture, and soil depth are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland 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.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. 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 grazed 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 evaluation of the present condition of the range vegetation in relation to its potential. Range condi-

tion 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.

Engineering

J.C. Ward, area engineer, Soil Conservation Service, prepared 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 information 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, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material.

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 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 generally 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 that 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 made for pipelines, sewerlines, communications 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 given, 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 of the structure 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 and in-place density, and depth were also considered. 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 hazard.

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, shrink-swell potential, and potential frost action 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. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

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 can 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, a system to lower the seasonal water table can be installed or the size of the absorption field can 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. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. 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 soil material affect the performance of embankments.

Sanitary landfill is 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 a thin layer of soil material. 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, are deep to a seasonal water table, 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 can 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.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

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.

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; sandy 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 and depth to a seasonal high water table 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 depth to the water table or other 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, slope, 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, and steep 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.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

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, need for drainage, and depth to the water table.

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, 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 plan-

ning, 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

Don Viktorin, biologist, Soil Conservation Service, prepared this section.

Wildlife is numerous and varied in Blanco and Burnet Counties. Nearly all of the range has a secondary land use as wildlife habitat, and a few areas are used mostly by wildlife. The principal wildlife are deer, turkey, squirrel, bobwhite quail, dove, rabbit, and many nongame birds and animals. Fox, raccoon, ringtail cat, skunk, opossum, bobcat, and coyote are furbearers that inhabit the range. Several exotic big game species, for example, axis deer, sika deer, fallow deer, red deer, blackbuck antelope, barbados sheep, and mouflon sheep, have been introduced into the area by ranchers.

Fish and waterfowl are also resources of economic importance in the counties. Approximately 16,960 acres in the survey area is inland water. Water is impounded in Buchanan, Travis, and Lyndon B. Johnson and Inks Lakes, and these water areas, together with numerous farm and ranch ponds and many streams and rivers, are used by migrating ducks and geese. In addition, most of the ponds are stocked with fish and all of the lakes and rivers provide good fishing. Black and white bass, channel and yellow catfish, crappie, and sunfish are important fish species.

The following section provides information about wildlife habitat in Blanco and Burnet Counties.

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, is inadequate, or is 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. 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. 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. 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. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

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.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs.

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. 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.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

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 a 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.

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 0.43. 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.

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 or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils 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 imperviious 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 rains or after snow melts is not considered flooding, nor is water in swamps and marshes. 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 on 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 mapping of the soil. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable rock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 16.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Texas State Department of Highways and Public Transportation.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and the Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-66T); grain size distribution (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57).

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 that is 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.

Aledo series

The Aledo series consists of shallow, well drained, loamy and gravelly soils on uplands. These soils formed in material weathered from interbedded limestone and marl. Slopes range from 1 to 8 percent.

Typical pedon of Aledo gravelly clay loam, in an area of Aledo association, undulating, in range; from the intersection of U.S. Highway 281 and Ranch Road 963 in the town of Burnet, 15.5 miles northeast on Ranch Road 963, and 100 feet north:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; many fine roots; many fine pores; 25 percent by volume angular limestone pebbles and cobbles; few calcium carbonate plates 1/4 inch to 4 inches across; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 13 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm, sticky; common fine roots; common fine pores; 60 percent by volume angular limestone cobbles 5 to 6 inches across; calcareous; moderately alkaline; abrupt smooth boundary.

R—13 to 16 inches; strongly cemented, fractured limestone in rounded fragments 6 to 12 inches across the long axis.

The solum ranges from 10 to 17 inches in thickness over cemented or indurated limestone. Limestone fragments that are mostly less than 5 inches, but may range to as much as 12 inches across, range from 5 to 30 percent by volume in the A11 horizon and from 40 to 70 percent by volume in the A12 horizon. Calcium carbonate equivalent of the solum is 40 to 60 percent.

The A horizon is dark brown, dark grayish brown, or very dark grayish brown. The A11 horizon is clay loam, loam, gravelly clay loam, very gravelly clay loam, or gravelly loam. The A12 horizon is very gravelly loam or very gravelly clay loam. The R layer is cemented or indurated limestone or marl.

Anhalt series

The Anhalt series consists of moderately deep, well drained, clayey soils that formed in residuum from limestone. Slopes range from 0 to 3 percent.

Typical pedon of Anhalt clay, 1 to 3 percent slopes, at the center of a microdepression; from the intersection of Spur 163 and Ranch Road 165 in the town of Blanco, 4.2 miles east on Ranch Road 165, 0.3 mile east and 0.25 mile south on private ranch road, and 450 feet east in cultivated field:

Ap—0 to 6 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine granular; extremely hard, very firm, very sticky and plastic; many fine and few medium roots; many fine and few medium pores; few angular chert pebbles; neutral; abrupt smooth boundary.

A1—6 to 15 inches; dark reddish brown (5YR 3/2) clay, dark reddish brown (5YR 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine and medium roots; distinct pressure faces; faint clay films; many distinct intersecting slickensides; vertical cracks 1/8 to 1/4 inch wide filled with soil from upper layer; neutral; gradual smooth boundary.

B2—15 to 29 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; many distinct intersecting slickensides; vertical cracks 1/8 to 1/4 inch wide filled with soil from upper layer; few fine roots; few fine calcium carbonate fragments; neutral; clear wavy boundary.

R—29 to 44 inches; strongly cemented, fractured limestone; upper 4 inches consist of weakly cemented rounded limestone and chert pebbles and cobbles; clayey material in some cracks and crevices.

The solum ranges from 21 to 38 inches over limestone. Reaction is neutral or mildly alkaline. Cycles of microknolls and microdepressions occur at intervals of 3 to 15 feet. The microknolls are from 4 to 12 inches higher than the microdepressions.

The Ap horizon is dark reddish brown, reddish brown, or dark reddish gray. The A1 horizon is dark reddish brown or reddish brown. The B2 horizon is reddish brown or dark reddish brown. In a few pedons, weakly cemented calcium carbonate is in the lower part of the B2 horizon overlying the limestone bedrock.

Bolar series

The Bolar series consists of moderately deep, well drained, loamy soils that formed in material weathered from interbedded limestone and calcareous marl. Slopes are concave and range from 1 to 5 percent.

Typical pedon of Bolar clay loam, 1 to 3 percent slopes, in range; from the intersection of Farm Road 963 and U.S. Highway 281 in the town of Burnet, 21.0 miles north on U.S. Highway 281, 3.0 miles southeast on U.S. Highway 183, 0.2 mile south on private ranch road, and 100 feet west:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky and moderate fine granular structure; hard, friable, sticky; many fine and medium roots; many fine and medium pores; common very fine calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

B21ca—13 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky and weak fine granular structure; hard, friable, sticky; common fine roots; common very fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B22ca—18 to 25 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, sticky; few cemented concretions of calcium carbonate; few medium soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23ca—25 to 33 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, sticky; about 15 percent by volume rounded concretions of calcium carbonate pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B3ca&R—33 to 38 inches; interbedded cemented limestone fragments with thin coatings of secondary calcium carbonate and brown (7.5YR 5/4) clay loam; abrupt smooth boundary.

R—38 to 39 inches; cemented limestone and marl.

The solum ranges from 24 to 40 inches in thickness over limestone or calcareous marl. Calcium carbonate equivalent ranges from 44 to 51 percent.

The A horizon is very dark grayish brown, dark grayish brown, brown, or dark brown. The B horizon is brown, very pale brown, pale brown, dark yellowish brown, dark grayish brown, or pale yellow clay loam or silty clay loam. The R layer is fractured, cemented, or indurated limestone that is interbedded with clayey marl.

Brackett series

The Brackett series consists of shallow, well drained, sloping, undulating, and hilly soils on uplands. These soils formed in material weathered from interbedded soft limestone and marly earth. The sequence of more resistant layers of limestone with the softer strata of marl results in a stairstepped or benched appearance in the landscape. Slopes range from 1 to 30 percent.

Typical pedon of Brackett clay loam, in an area of Brackett association, undulating, in range; from the Federal Building in Johnson City, 6.0 miles south and 3.5 miles east on U.S. Highway 290 to intersection with Middle Creek Road, 0.45 mile south on Middle Creek Road, and 100 feet east:

A1—0 to 5 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky; common fine roots; 5 percent by volume small rounded weakly cemented limestone fragments; moderately alkaline; clear wavy boundary.

B2—5 to 14 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky; few fine roots; common fine pores; 10 percent by volume limestone pebbles; 67 percent calcium carbonate equivalent; moderately alkaline; clear wavy boundary.

Cr—14 to 30 inches; pale yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) moist; massive; 50 percent by volume weakly cemented bodies of segretated calcium carbonate and limestone.

The solum ranges from 10 to 19 inches in thickness. Content of coarse fragments ranges from a few limestone pebbles to 25 percent by volume. Calcium carbonate equivalent ranges from 60 to 75 percent.

The A horizon is very pale brown, pale brown, brown, light yellowish brown, or light brownish gray loam or clay loam or their gravelly analogs that have clay content ranging from 20 to 34 percent. The B2 horizon is light yellowish brown, very pale brown, pale brown, light yellowish brown, or yellowish brown. The Cr horizon is pale yellow, olive yellow, or light brownish gray weakly cemented limestone, segregated calcium carbonate, and loamy material.

Click series

The Click series consists of deep, gently sloping, somewhat excessively drained soils on uplands. These soils formed in loamy residuum weathered from granite. The slopes range from 1 to 5 percent.

Typical pedon of Click gravelly sandy loam, 1 to 5 percent slopes, in range; from the junction of Ranch Road 1323 and U.S. Highway 281 north of Johnson City, 7.0 miles northwest and 150 feet south, at a place which is 150 feet west of Sandy School:

A1—0 to 9 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; single grain; hard, very friable; common fine and medium roots; about 20 percent by volume angular feldspar and quartz gravel about 1/4 inch across; neutral; gradual smooth boundary.

A2—9 to 14 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; single grain; hard, very friable; common fine roots; about 20 percent by volume angular feldspar and quartz gravel about 1/4 inch across; slightly acid; gradual smooth boundary.

B21t—14 to 26 inches; reddish brown (5YR 5/4) gravelly sandy loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, friable; patchy clay films in pores and coatings on coarse sand and fine gravel; contains about 40 percent by volume angular feldspar and quartz pebbles as much as 1/2 inch across; slightly acid; gradual smooth boundary.

B22t—26 to 36 inches; light reddish brown (5YR 6/4) gravelly sandy loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, very friable; clay films in pores and clay coatings on coarse sand and fine gravel; contains about 40 percent quartz and feldspar gravel, the pebbles are 1/8 to 1/4 inch across; slightly acid; gradual smooth boundary.

C&B23t—36 to 54 inches; pink (7.5YR 7/4) partially weathered granite (saprolite) that has about 15 percent yellowish brown (10YR 5/4) gravelly sandy loam; weak fine subangular blocky structure; clay films on saprolite and clay flows along some cleavage planes; saprolite ranges from 1/8 to 1/4 inch across and contains common mica flakes; slightly acid; gradual wavy boundary.

R—54 to 56 inches; pink indurated granite bedrock.

The solum ranges from 40 to 60 inches in thickness over granite. Reaction of the soil ranges from neutral to slightly acid.

The A horizon is very pale brown, brown, yellowish brown, light brown, or dark yellowish brown gravelly sandy loam or gravelly loamy sand. The A horizon has 40 to 60 percent content of coarse and very coarse sand and 20 to 30 percent content of feldspar and quartz pebbles ranging from 2 millimeters to 15 millimeters in size. The Bt horizon is reddish brown, light reddish brown, yellowish red, brown, light brown, reddish yellow, yellowish brown, or brownish yellow gravelly sandy loam. The Bt horizon has 12 to 18 percent content of clay and 35 to 60 percent content of gravel. The C&B23t horizon is pink or strong brown.

Doss series

The Doss series consists of shallow, well drained soils that formed in material weathered from calcareous marl and weakly cemented limestone. Slopes range from 1 to 5 percent.

Typical pedon of Doss silty clay, 1 to 5 percent slopes, in a live oak mott; from intersection of Farm Road 1323 and the Blanco-Gillespie county line, 1.3 miles east, 0.6 mile south on private road, and 60 feet east:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky; many fine and medium grass roots; few fine pores; about 15 percent by volume very fine soft bodies of calcium carbonate; moderately alkaline; clear smooth boundary.

B2ca—9 to 17 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky; common fine and medium roots; common fine and medium pores; about 25 percent by volume soft and cemented bodies and threads of calcium carbonate; moderately alkaline; clear wavy boundary.

Cca—17 to 60 inches; pink (7.5YR 8/4) cemented caliche in fragments 1 inch to 4 inches across, becoming softer and massive as depth increases.

The solum ranges from 13 to 19 inches in thickness over weakly cemented caliche. The clay content in these soils ranges from 37 to 45 percent and the content of coarse fragments from 3 to 10 percent. In some areas 5 to 15 percent coarse pebbles are on the surface. Calcium carbonate equivalent ranges from 47 to 56 percent.

The A horizon is dark grayish brown, very dark grayish brown, or dark brown. The B horizon is brown or reddish brown silty clay or clay loam. The Cca horizon is pink, pinkish gray, very pale brown, or light yellowish brown. It is soft limy earth of clay loam texture, weakly cemented limestone, caliche, or marl.

Eckert series

The Eckert series consists of shallow and very shallow, well drained, stony soils that formed in material weathered from Cap Mountain limestone. Slopes range from 2 to 20 percent.

Typical pedon of Eckert stony loam in an area of Eckert-Rock outcrop association, rolling, in range; from junction of U.S. Highway 281 and Farm Road 1323 north of Johnson City, 4.2 miles northwest on Farm Road 1323, and 75 feet northeast of centerline of road:

A1—0 to 7 inches; dark brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; slightly sticky; angular limestone fragments 1 to 10 inches across that cover about 50 percent of the surface and make up about 50 percent of the soil volume; mildly alkaline; abrupt wavy boundary.

R—7 to 8 inches; fractured, indurated limestone.

The solum ranges from 4 to 14 inches in thickness over limestone. Coarse fragments cover 40 to 75 percent of the surface and make up 35 to 60 percent of the soil content. The fine-earth fraction is dark grayish brown, dark brown, or dark reddish gray and ranges from loam to silt loam. It is about 17 to 27 percent clay. Reaction ranges from neutral to mildly alkaline.

Eckrant series

The Eckrant series consists of shallow, well drained soils that formed in material weathered from limestone. Slopes range from 1 to 20 percent.

Typical pedon of Eckrant very cobbly clay in an area of Eckrant association, undulating, in range; from the intersection of Spur 354 and U.S. Highway 290, 2.0 miles west on U.S. Highway 290, 2.5 miles southwest on Flat Creek Road, 1.0 mile south on private ranch road, and 50 feet east:

A11—0 to 4 inches; very dark gray (10YR 3/1) very cobbly clay; black (10YR 2/1) moist; compound moderate fine subangular blocky and moderate fine granular structure; very hard, firm, very sticky; common fine roots; few fine pores; about 20 percent by volume angular limestone pebbles; angular limestone cobbles that cover about 40 percent of the surface and make up about 40 percent of the soil volume; neutral; clear wavy boundary.

A12—4 to 11 inches; very dark gray (10YR 3/1) very cobbly clay; black (10YR 2/1) moist; compound moderate fine subangular blocky and moderate fine granular structure; very hard, firm, very sticky; common fine roots; about 60 percent by volume angular limestone cobbles and pebbles; neutral; abrupt wavy boundary.

R—11 to 12 inches; fractured indurated limestone bedrock.

The solum ranges from 8 to 18 inches in thickness. The A11 horizon is very dark gray, dark grayish brown, very dark grayish brown, or dark brown. The A12 horizon is very dark gray, very dark grayish brown, or dark brown. Coarse fragments mostly cobble size make up from 35 to 70 percent of the soil content. Reaction ranges from neutral to moderately alkaline.

Harper series

The Harper series consists of shallow, well drained, stony soils on uplands. These soils formed in clayey sediment that weathered from dolomite limestone. Slopes range from 1 to 8 percent.

Typical pedon of Harper stony clay, in an area of Harper-Rock outcrop association, rolling, in range; from intersection of U.S. Highway 281 and Ranch Road 2766 in Johnson City, 3.2 miles east on Ranch Road 2766 to ranch gate entrance, and 750 feet north:

A11—0 to 4 inches; black (10YR 2/1) clay, black (10YR 2/1) moist; moderate fine granular and moderate medium subangular blocky structure; hard, firm, sticky and plastic; many fine roots; dolomite cobbles and stones cover 45 to 50 percent of the surface and rounded pebbles and cobbles make up 5 to 10 percent of the soil; moderately alkaline; clear wavy boundary.

A12—4 to 18 inches; black (10YR 2/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; hard, firm, sticky and plastic; common fine roots; common tubes and insect burrows; 5 to 10 percent by volume angular dolomite pebbles; moderately alkaline; abrupt wavy boundary.

R—18 to 19 inches; indurated, fractured, massive, fine grain, dolomite limestone.

The solum ranges from 11 to 18 inches in thickness over indurated dolomite limestone. The fine earth fraction ranges from 40 to 55 percent content of clay. Dolomite fragments range from 2 inches to 4 feet across and cover 45 to 70 percent of the surface. These fragments make up 0 to 10 percent of the soil content.

The horizons are black, very dark gray, or very dark brown. Reaction of the soil is mildly alkaline or moderately alkaline.

Heaton series

The Heaton series consists of deep, well drained, sandy soils that formed in thick reddish loamy sediment. Slopes range from 1 to 5 percent.

Typical pedon of Heaton loamy fine sand, 1 to 5 percent slopes, in range; from intersection of U.S. Highway 281 and Ranch Road 962 in the town of Round Mountain, 5.0 miles southeast on Ranch Road 962, 2.2 miles south, and 200 feet east:

A11—0 to 7 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grain; loose, very friable; common fine roots; neutral; clear smooth boundary.

A12—7 to 22 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grain; loose, very friable; common fine roots; neutral; clear smooth boundary.

B21t—22 to 37 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable, sticky; few fine roots and pores; thin, discontinuous clay films; neutral; diffuse smooth boundary.

B22t—37 to 68 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; moderate medium subangular blocky structure; hard, friable, sticky; few fine pores; neutral; smooth diffuse boundary.

B23t—68 to 80 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; few fragments of weathered sandstone; neutral.

The solum ranges from 60 to more than 80 inches in thickness. Reaction of the soil is neutral to slightly acid.

The A horizon is brown, light brown, pink, or reddish brown. The Bt horizon is red, yellowish red, or reddish brown sandy clay loam that has about 24 to 35 percent content of clay.

Hensley series

The Hensley series consists of shallow, well drained, gently sloping to sloping soils on erosional uplands. These soils formed in clayey residuum from limestone. They occupy hilltop positions and have slopes of 1 to 8 percent.

Typical pedon of Hensley stony loam in an area of Hensley association, undulating, in range; from the intersection of U.S. Highway 281 and U.S. Highway 290 in Johnson City, 3.0 miles north on U.S. Highway 281, 3.6 miles east on private ranch road, and 50 feet north:

A1—0 to 5 inches; reddish brown (5YR 4/4) stony loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky; common fine and few medium roots; about 20 percent limestone fragments on surface; about 15 percent by volume angular quartz fragments 1/4 to 1/2 inch across in the soil; neutral; clear smooth boundary.

B2t—5 to 18 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate fine blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; 10 percent by volume quartz and chert fragments 1/8 to 1/2 inch across; neutral; abrupt smooth boundary.

R—18 to 19 inches; indurated fractured limestone.

The solum ranges from 10 to 18 inches in thickness over limestone. From 5 to 25 percent quartz and chert pebbles cover the surface and make up the soil content. Reaction of the soil is neutral to mildly alkaline.

The A horizon is reddish brown or brown loam or clay loam or their gravelly analogs that have clay content ranging from 25 to 38 percent. Where chroma is 3 or less, the horizon makes up less than one-third the thickness of the solum. The Bt horizon is reddish brown, dark reddish brown, or red clay loam or clay or their gravelly analogs that have clay content ranging from 35 to 50 percent.

Houston Black series

The Houston Black series consists of deep, moderately well drained soils that formed in calcareous clay and marl. Slopes range from 0 to 3 percent.

Typical pedon of Houston Black clay, 0 to 1 percent slopes, in a microdepression; from the intersection of U.S. Highway 183 and Ranch Road 2657 in the town of Briggs, 0.5 mile south on U.S. Highway 183, and 50 feet east:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky and moderate medium granular structure; extremely hard, very firm, very sticky and plastic; few fine roots; moderately alkaline; abrupt smooth boundary.

A11—6 to 25 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; shiny ped faces; few fragments of snail shells; moderately alkaline; gradual wavy boundary.

A12—25 to 42 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium dark grayish brown (2.5Y 4/2) mottles; moderate medium angular blocky structure; intersecting slickensides; extremely hard, very firm, sticky and plastic; few fragments of snail shells; few medium soft bodies of calcium carbonate; moderately alkaline; gradual wavy boundary.

AC1—42 to 50 inches; grayish brown (10YR 5/2) clay, dark gray (10YR 4/1) moist; moderate medium angular blocky structure; shiny ped faces; few streaks of very dark gray from upper horizon and few very dark grayish brown streaks; common soft bodies of calcium carbonate; few fine black concretions; moderately alkaline; gradual wavy boundary.

AC2—50 to 80 inches; grayish brown (10YR 5/2) clay with distinct coarse light olive brown mottles; weak medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine masses of iron-manganese concretions; 5 percent by volume strongly cemented medium calcium carbonate concretions; few soft powdery bodies of calcium carbonate; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Clay content ranges from about 50 to 60 percent. When dry, this soil has cracks that range from 1/2 inch to 3 inches wide to a depth of 16 inches. Intersecting slickensides begin at a depth of about 25 inches.

The A horizon is black, very dark gray, or dark gray. Matrix colors or mottles of more than 1.5 chroma are at a depth of more than 38 inches in 20 to 50 percent of the pedon. The AC horizon is light brownish gray, grayish brown, pale olive, or light olive brown.

Hye series

The Hye series consists of moderately deep, well drained soils that formed in material weathered from sandstone. Slopes range from 1 to 5 percent.

Typical pedon of Hye fine sandy loam, 1 to 5 percent slopes, in range; from intersection of U.S. Highway 281 and Ranch Road 962 in the town on Round Mountain, 6.1 miles northwest on Ranch Road 962, 0.7 mile south-

west on Round Mountain to county road, and 150 feet southeast:

A1—0 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, very friable, slightly sticky; common fine and medium roots; common fine pores; common worm casts and burrows; few black concretions; neutral; gradual smooth boundary.

B1—12 to 18 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, very friable; slightly sticky; common fine roots; few fine and medium pores; common worm casts; few black concretions; slightly acid; clear smooth boundary.

B21t—18 to 26 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable, sticky; common fine roots; patchy clay films on faces of peds; continuous clay films on sandstone fragments; about 20 percent by volume angular sandstone pebbles and cobbles in a horizontal line 2 inches thick; common fine and medium black concretions and dark sandstone fragments; slightly acid; gradual smooth boundary.

B22t—26 to 36 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak medium subangular and angular blocky structure; hard, friable, sticky; patchy clay films on faces of peds; continuous clay films on sandstone fragments; common fine weak black concretions; about 10 percent by volume angular sandstone pebbles less than 1/8 inch across; slightly acid; clear smooth boundary.

R—36 to 40 inches; indurated sandstone bedrock.

The solum is 20 to 40 inches in thickness overlying sandstone. Base saturation of the argillic horizon ranges from 40 to 75 percent. In some pedons a stone line of unweathered sandstone 1/2 inch to 4 inches thick is within some part of the solum. Reaction of the soil is neutral or slightly acid.

The A horizon is reddish brown, yellowish red, brown, or dark brown fine sandy loam that has about 10 to 20 percent clay. The Bt horizon is reddish brown, red, or yellowish red sandy clay loam or fine sandy loam that has about 18 to 32 percent content of clay. Some pedons have brownish, yellowish, and grayish mottles below a depth of 30 inches. The R layer roughly parallels the surface. It is fractured at intervals of 2 to 12 feet, and has a hardness of more than 3 on Moh's scale.

Karnes series

The Karnes series consists of deep, well drained soils that formed in loamy sediment. Slopes range from 1 to 3 percent.

Typical pedon of Karnes loam, 1 to 3 percent slopes, in range; from the intersection of U.S. Highway 281 and Ranch Road 473 in the town of Twin Sisters, 2.3 miles east on Ranch Road 473, and 150 feet south:

A1—0 to 11 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky; common fine and medium roots; common fine and medium tubes and pores; few insect burrows; few fine cemented bodies of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2—11 to 23 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky and weak fine granular structure; slightly hard, friable, slightly sticky; common fine and few medium roots; many fine and medium tubes and pores; few insect burrows; few lenses of rounded calcareous pebbles 1/2 to 1 inch across; calcareous; moderately alkaline; gradual smooth boundary.

B3—23 to 49 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; hard, firm, sticky; many threads of calcium carbonate; few snail shells; calcareous; moderately alkaline; gradual smooth boundary.

Cca—49 to 72 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky; many fine threads, soft bodies, and cemented fragments of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 36 to about 50 inches in thickness. Calcium carbonate content ranges from 45 to 60 percent.

The A horizon is grayish brown, light brownish gray, or yellowish brown. The B horizon is pale brown, light yellowish brown, or pinkish gray fine sandy loam that has 12 to 18 percent silicate clay. Limestone pebbles 1/4 to 1/2 inch in size range from 1 to 5 percent by volume. In places the pebbles are in a discontinuous horizontal wavy line 1 inch to 3 inches thick.

Katemcy series

The Katemcy series consists of moderately deep, well drained soils that formed in material weathered from schist. Slopes range from 1 to 5 percent.

Typical pedon of Katemcy loam, 1 to 5 percent slopes, in range; from the intersection of U.S. Highway 281 and Ranch Road 962 in the town of Round Mountain, 7.5

miles northwest on Ranch Road 962, 4.1 miles west-southwest on Round Mountain-Willow City Road, and 45 feet southeast:

A1—0 to 9 inches; reddish brown (5YR 4/3) loam in upper part, sandy clay loam below five inches; dark reddish brown (5YR 3/3) moist; moderate medium subangular and angular blocky structure; very hard, firm, sticky; common fine roots; common fine and medium tubes and pores; few medium worm casts and burrows; few fine quartz fragments; slightly acid; gradual smooth boundary.

B2t—9 to 28 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few thin continuous clay skins; few 1/8 to 1/4 inch subrounded quartz and feldspar fragments that have clay coatings; vertical cracks 1/8 inch wide filled with soil from upper layer; neutral; gradual wavy boundary.

B3—28 to 35 inches; dark reddish brown (5YR 3/3) gravelly clay loam, dark reddish brown (5YR 3/3) moist; few fine faint mottles of red and black; moderate fine subangular blocky structure; extremely hard, very firm, sticky; 10 to 20 percent by volume angular schist fragments 2 to 3 inches across; neutral; clear wavy boundary.

Cr—35 to 44 inches; weathered fractured indurated tilted schist; clay coatings in fractures.

The solum ranges from 22 to 38 inches in thickness overlying schist. Reaction of the soil ranges from slightly acid to mildly alkaline.

The A horizon is reddish brown. The Bt horizon is red, reddish brown, or dark reddish brown clay. Clay content ranges from about 40 to 50 percent. The B3 horizon is reddish brown, dark reddish brown, or red gravelly clay loam or gravelly clay. The R layer is weakly cemented to indurated weathered schist or schistose gneiss.

Keese series

The Keese series consists of shallow, well drained soils that formed in material weathered from granite. Slopes range from 5 to 16 percent.

Typical pedon of Keese gravelly sandy loam in an area of Keese-Rock outcrop association, rolling, in range; from the town of Sandy which is about 10 miles northwest of Johnson City, 4.3 miles northwest on private ranch road to ranch headquarters, 0.3 mile southwest, and 50 feet west:

A1—0 to 9 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; hard, friable, slightly sticky; common fine and medium roots; about 20 percent by volume feldspar fragments less than 1/2 inch across; slightly acid; gradual wavy boundary.

B2—9 to 17 inches; strong brown (7.5YR 5/6) gravelly sandy loam, strong brown (7.5YR 4/6) moist; weak fine granular structure; very hard, friable, slightly sticky; about 25 percent by volume feldspar and quartz fragments less than 1/2 inch across; slightly acid; abrupt wavy boundary.

R—17 to 20 inches; indurated granite.

The solum ranges from 11 to 20 inches in thickness overlying granite. Reaction of the soil ranges from medium acid to slightly acid.

The A horizon is yellowish brown or light yellowish brown. The B2 horizon is strong brown or yellowish brown.

Krum series

The Krum series consists of deep, well drained soils that formed in thick beds of calcareous, clayey sediment.

Typical pedon of Krum clay, 3 to 5 percent slopes, in range; from the intersection of U.S. Highway 281 and U.S. Highway 290 in Johnson City, 4.4 miles north on U.S. Highway 281, 0.6 mile east to ranch headquarters, 1.6 miles northeast on ranch road; and 50 feet west:

A11—0 to 13 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and moderate medium granular structure; hard, firm, sticky; common fine and medium roots; many fine pores; vertical cracks 3 to 5 millimeters wide; few very fine calcium carbonate fragments; calcareous; moderately alkaline; clear smooth boundary.

A12—13 to 27 inches; dark grayish brown (10YR 4/2) clay; very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores; vertical cracks 3 to 5 millimeters wide; common very fine calcium carbonate concretions; few broken snail shells; calcareous; moderately alkaline; gradual wavy boundary.

B2—27 to 39 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; few medium wedge shaped peds with distinct pressure faces; hard, firm, sticky; common fine pores; few films, threads, and concretions of calcium carbonate; common sand and fine gravel; calcareous; limestone; moderately alkaline; gradual smooth boundary.

Cca—39 to 72 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; massive; extremely hard, firm, very sticky and plastic; 15 percent by volume of limestone fragments less than about 8 millimeters in size; few films, threads, and concretions of calcium

carbonate; few snail shells; calcareous; moderately alkaline.

The solum ranges from 38 to 60 inches in thickness. The A horizon is very dark grayish brown, dark grayish brown, or dark brown. The B2 horizon is brown, yellowish brown, or grayish brown. The Cca horizon is pale brown, light yellowish brown, or brownish yellow. Soft bodies, threads, and concretions of calcium carbonate range from 2 to 20 percent by volume below a depth of 40 inches.

Lewisville series

The Lewisville series consists of deep, well drained soils that formed in alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Lewisville clay loam, 1 to 3 percent slopes, in cultivated field; from the intersection of Ranch Road 2657 and Ranch Road 963 in the town of Oakalla, 2.4 miles southwest on Ranch Road 963, and 300 feet west:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; many fine and common medium roots; few very fine cemented fragments of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; common fine roots; few very fine rounded cemented fragments of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—18 to 58 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; hard, firm, sticky; common fine soft and cemented bodies and fragments of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—58 to 63 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak subangular blocky structure; hard, firm, sticky; about 20 percent threads, soft and cemented bodies of calcium carbonate; few cemented angular fragments of calcium carbonate 1/2 inch to 3 inches across; calcareous; moderately alkaline.

The solum ranges from 30 to 64 inches in thickness. The content of calcium carbonate in the 10- to 40-inch control section ranges from 23 to 38 percent.

The A horizon is brown, grayish brown, dark grayish brown, or dark brown. The B horizon is brown, light brown, light yellowish brown, yellowish brown, or light brownish gray clay loam or silty clay loam that has 5 to 20 percent visible carbonates. Depth to gravel ranges from 3 feet to more than 8 feet.

Ligon series

The Ligon series consists of shallow, well drained soils that formed in material weathered from schist. Slopes range from 1 to 8 percent.

Typical pedon of Ligon clay loam in an area of Ligon-Rock outcrop association, undulating, in range; from the intersection of Ranch Road 962 and Althaus Road, which is about 8.0 miles northwest of the town of Round Mountain, 0.75 mile west, and 75 feet north of center of road:

A1—0 to 4 inches; reddish brown (5YR 4/4) clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, slightly sticky; many fine and common medium roots; few tubes and pores; neutral; clear wavy boundary.

B2t—4 to 15 inches; red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; hard, friable, sticky; common fine roots; few soft bodies of schist; few mica particles; few distinct clay films; neutral; clear wavy boundary.

C1—15 to 21 inches; partially decomposed schist; clear wavy boundary.

Cr—21 to 22 inches; weakly cemented schist, hardness of 2.5 on Moh's scale.

The solum ranges from 12 to 17 inches in thickness. Angular quartz and schist pebbles and cobbles range from 10 to 20 percent on the surface and from 5 to 10 percent in the soil. Reaction of the soil ranges from slightly acid to mildly alkaline.

The A horizon is dark reddish brown, reddish brown, or yellowish red loam or clay loam. The Bt horizon is dark reddish brown, dark red, red, or reddish brown clay loam that has 30 to 35 percent content of clay. The upper 6 inches of the C horizon has pockets and seams of fine earth in the cleavage planes.

Luckenbach series

The Luckenbach series consists of deep, well drained soils that formed in thick beds of calcareous clay loam and clay. Slopes range from 1 to 3 percent.

Typical pedon of Luckenbach clay loam, 1 to 3 percent slopes; from intersection of U.S. Highway 281 and Texas Highway 29 in the town of Burnet, 0.2 mile east, 1.8 miles south on Mormon Mill county road, and 0.3 mile southeast:

Ap—0 to 6 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; moderate fine subangular blocky structure; hard, firm, sticky; mildly alkaline; abrupt smooth boundary.

A1—6 to 17 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, sticky; mildly alkaline; clear smooth boundary.

B21t—17 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky and blocky structure; hard, firm; few fine concretions of calcium carbonate below a depth of about 20 inches; moderately alkaline; gradual smooth boundary.

B22tca—25 to 36 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky and blocky structure; hard, firm; about 10 percent by volume soft calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

C1ca—36 to 48 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable; about 15 percent by volume soft and hard bodies of calcium carbonate and fragments of limestone; calcareous; moderately alkaline; clear smooth boundary.

C2ca—48 to 80 inches; very pale brown (10YR 7/3) clay loam; massive; about 25 percent by volume calcium carbonate concretions and limestone fragments.

The solum ranges from 36 to 48 inches in thickness. Depth to secondary carbonates ranges from 19 to 28 inches.

The A horizon is dark reddish gray, dark brown, or dark grayish brown. Reaction is neutral or mildly alkaline. The Bt horizon is reddish brown. The C horizon has 5 to 15 percent by volume soft bodies, lumps, and weakly and strongly cemented concretions of calcium carbonate that do not decrease appreciably as depth increases.

Nebgen series

The Nebgen series consists of shallow, well drained soils that formed in material weathered from sandstone. Slopes range from 3 to 20 percent.

Typical pedon of Nebgen fine sandy loam in an area of Nebgen-Oben-Rock outcrop association, rolling, in range; from the town of Sandy which is about 10 miles northwest of Johnson City, 1:1 miles west on Ranch Road 1323 to fence gate, and 150 feet north:

A1—0 to 14 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky and weak medium granular structure; soft, very friable, slightly sticky; common fine and medium roots; common fine pores; 10 to 15 percent angular sandstone cobbles on surface; neutral; clear wavy boundary.

C—14 to 19 inches; reddish brown (5YR 5/4) partially weathered cemented sandstone, reddish brown (5YR 4/4) moist; about 25 percent reddish brown (5YR 5/4) fine sandy loam in fractures and interstices; massive; neutral; abrupt wavy boundary.

Cr—19 to 23 inches; strongly cemented platy sandstone.

The solum ranges from 4 to 14 inches in thickness. It is light reddish brown, reddish brown, or brown fine sandy loam or loam that has about 15 to 20 percent content of clay. Soils that have chroma of less than 3.5 are less than 4 inches thick. Reaction of the soil is neutral or slightly acid.

The C horizon is partially weathered weakly cemented or cemented sandstone. The Cr horizon is reddish or brownish, strongly cemented sandstone; however, it can be broken easily when moist. Sandstone pebbles and cobbles cover from 10 to 25 percent of the surface.

Oakalla series

The Oakalla series consists of deep, well drained soils that formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Oakalla silty clay loam, in a cultivated field; from intersection of U.S. Highway 290 and Ranch Road 1 which is 0.5 mile west of the town of Hye, 0.1 mile west on Ranch Road 1, and 150 feet north:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; common fine roots; about 43 percent calcium carbonate equivalent; few very fine weakly cemented bodies of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

A11—8 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; common fine roots; about 43 percent calcium carbonate equivalent; few very fine weakly cemented bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

A12—16 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm, sticky; common fine roots; common fine pores; about 41 percent calcium carbonate equivalent; few very fine weakly cemented bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—23 to 60 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; massive; hard, firm, sticky; about 50 percent calcium carbonate equivalent; few films and threads of calcium carbonate and few weakly cemented bodies of calcium carbonate; few shell fragments; few dark streaks; calcareous; moderately alkaline.

The mollic epipedon is 20 to 34 inches thick. Calcium carbonate equivalent of the 10- to 40-inch control section ranges from 40 to 55 percent. Limestone pebbles make up as much as 10 percent of any one horizon to a depth of 72 inches.

The A horizon is very dark grayish brown, dark grayish brown, or dark brown silty clay loam or loam that has 25 to 40 percent clay. About 5 to 12 percent of the clay is carbonate clay. Some pedons have a B2 horizon below a depth of 20 inches that is brown, dark yellowish brown, yellowish brown, or light yellowish brown silty clay loam, loam, or clay loam. The C horizon is brown, yellowish brown, or light yellowish brown silty clay loam, loam, or clay loam. In some pedons, sediment of contrasting textures is at a depth of 6 to 10 feet.

Oben series

The Oben series consists of shallow, well drained soils that formed in material weathered from strongly cemented sandstone. Slopes range from 1 to 5 percent.

Typical pedon of Oben fine sandy loam, 1 to 5 percent slopes, in a cultivated field; from the town of Sandy which is about 10 miles northwest of Johnson City, 1.5 miles south on Ranch Road 1323, 1.4 miles southeast to farmhouse, and 300 feet east:

A1—0 to 6 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, slightly sticky; common fine and medium roots; common fine tubes and pores; few soft angular sandstone fragments 1/4 to 1/2 inch across; neutral; clear wavy boundary.

B21t—6 to 14 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky; common fine and medium grass roots; common fine tubes and pores; few patchy clay films; few fine soft angular sandstone fragments 1/4 to 1/2 inch across; neutral; abrupt wavy boundary.

B22t—14 to 19 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky; common soft and weakly cemented sandstone fragments 1/4 to 1/2 inch across; neutral; abrupt wavy boundary.

Cr—19 to 26 inches; olive yellow (2.5Y 6/6) weakly cemented thick platy sandstone 1/4 to 3/4 inch across with Moh's hardness of about 2; soil and roots between plates; noncalcareous.

The solum ranges from 12 to 20 inches in thickness. The content of coarse fragments ranges from 5 to 15 percent in the soil. Plates or angular fragments from 4 to 12 inches across are on 10 to 15 percent of the surface.

The A horizon is light reddish brown or reddish brown. The Bt horizon is reddish yellow, light reddish brown, or reddish brown fine sandy loam or sandy clay loam that has 16 to 25 percent content of clay. The Cr horizon is reddish brown, reddish yellow, pink, or olive yellow sandstone plates or long angular fragments.

Owens series

The Owens series consists of shallow, well drained soils that formed in material weathered from clayey shale. Slopes range from 10 to 30 percent.

Typical pedon of Owens clay in an area of Owens association, hilly, in range; from intersection of U.S. Highway 281 and Texas Highway 29 in Johnson City, 0.2 mile east, 5.5 miles south on Mormon Mill county road, and 50 feet west:

A1—0 to 4 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak fine angular blocky structure; hard, firm, sticky; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.

Bca—4 to 12 inches; pale olive (5Y 6/4) clay, olive (5Y 5/4) moist; moderate medium angular blocky structure; hard, firm, sticky; common fine roots; about 5 percent by volume soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—12 to 18 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; massive; extremely hard, very firm, sticky; about 10 percent by volume soft bodies and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cr—18 to 25 inches; pale olive (5Y 6/4) shaly clay, olive (5Y 5/4) moist and weakly cemented platy shale.

The solum ranges from 12 to 20 inches in thickness. The soil ranges from clay loam to clay and contains from 0 to 15 percent coarse fragments. Clay content ranges from 37 to 45 percent.

The A horizon is pale olive or grayish brown, the Bca horizon is pale olive or olive brown, and the Cca horizon is olive or light olive brown. The Cr horizon is shaly clay or cemented shale.

Pedernales series

The Pedernales series consists of deep, well drained soils that formed in calcareous sandy clay loam. Slopes range from 1 to 5 percent.

Typical pedon of Pedernales fine sandy loam, 1 to 3 percent slopes, in range; from the junction of Ranch Road 962 and county road which is 6.8 miles northwest of the town of Round Mountain, 2.15 miles southwest on county road, and 10 feet south of road:

A1—0 to 11 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky; many fine and few medium roots; neutral; clear smooth boundary.

B21t—11 to 17 inches; red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm, sticky; common fine and medium roots; distinct clay films on ped faces; neutral; gradual smooth boundary.

B22t—17 to 38 inches; red (2.5YR 4/6) sandy clay, red (2.5YR 4/6) moist; moderate medium blocky structure; very hard, very firm, sticky; few fine roots; distinct clay films on ped faces; dark staining on ped faces; few fine black concretions; common fine limestone fragments; neutral; clear smooth boundary.

Cca—38 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common fine distinct red mottles; massive; hard, firm, sticky; about 20 percent by volume soft bodies of calcium carbonates; calcareous; moderately alkaline.

The solum ranges from 35 to 60 inches in thickness. Reaction of the soil ranges from slightly acid to moderately alkaline.

The A horizon is reddish brown or brown. The Bt horizon is red, yellowish red, or reddish brown sandy clay to clay. The Cca horizon is pink, light reddish brown, light brown, pink, or reddish yellow sandy clay loam or sandy clay.

Purves series

The Purves series consists of shallow, well drained soils that formed in material weathered from interbedded hard limestone and calcareous marl. Slopes range from 1 to 8 percent.

Typical pedon of Purves stony clay in an area of Purves association, undulating, in range; from the town of Cypress Mill, 2.0 miles northeast on county road, and 0.2 mile north:

A11—0 to 9 inches; very dark grayish brown (10YR 3/2) stony clay, very dark brown (10YR 2/2) moist; moderate medium angular blocky structure; hard, firm, sticky; many fine and medium roots; few angular limestone cobbles on surface and in the soil; calcareous; moderately alkaline; clear smooth boundary.

A12ca—9 to 16 inches; brown (10YR 4/3) cobbly clay, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, firm, sticky; many fine roots; about 25 percent by volume angular limestone fragments and calcium carbonate concretions ranging from 1 to 4 inches across; calcareous; moderately alkaline; abrupt wavy boundary.

R—16 to 18 inches; indurated fractured limestone bedrock; fragments have secondary calcium carbonate coatings 1/8 to 1/4 inch thick.

The solum ranges from 10 to 19 inches in thickness. Limestone pebbles and cobbles are on 5 to 30 percent of the surface and make up 5 to 30 percent of the soil volume.

The A horizon is very dark grayish brown, dark grayish brown, brown, or dark brown clay, gravelly clay, stony clay, or cobbly clay. Clay content ranges from 40 to 50 percent of the fine earth.

Real series

The Real series consists of shallow, well drained soils that formed in material weathered from interbedded limestone and marl. Slopes range from 8 to 20 percent.

Typical pedon of Real gravelly clay loam in an area of Brackett-Real association, hilly, in range; from the intersection of U.S. Highway 290 and Spur 354 in Johnson City, 5.5 miles south on county road, 2 miles west on private road to ranchhouse, and 0.4 mile west:

A11—0 to 8 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, friable, sticky; many fine and common medium roots; about 20 percent by volume weakly to strongly cemented angular limestone fragments 1/8 to 1 inch in size; calcareous; moderately alkaline; clear wavy boundary.

A12ca—8 to 15 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky and weak fine granular structure; hard, friable, sticky; many fine and common medium roots; about 60 percent by volume weakly cemented angular limestone fragments 1/2 inch to 3 inches in size that have 1/16 to 1/4 inch thick discontinuous coatings of secondary calcium carbonate; few cobbles and stones; calcareous; moderately alkaline; clear wavy boundary.

Cca—15 to 60 inches; pale yellow (2.5Y 7/4) cemented limestone and marl of silt loam texture; massive; few medium roots in seams; calcareous; moderately alkaline.

The solum ranges from 8 to 19 inches in thickness. Coarse limestone fragments from 1/8 inch to as much as 10 inches across make up from 35 to 70 percent by volume of the soil. Calcium carbonate equivalent is 55 to 70 percent.

The A horizon is dark grayish brown, dark brown, or very dark grayish brown loam or clay loam and their gravelly or cobbly analogs that have clay content of 27

to 35 percent. The Cca horizon is pale yellow, light yellowish brown, or white cemented limestone and marl.

Renick series

The Renick series consists of shallow, well drained soils that formed in material weathered from serpentine. Slopes range from 5 to 12 percent.

Typical pedon of Renick stony clay loam in an area of Renick association, rolling; from junction of Willow City-Round Mountain county road and the Click county road which is about 16 miles northwest of the town of Round Mountain, 1.4 miles southwest on private road, and 1.1 miles west, 0.3 mile west of Comanche Creek:

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; many fine and common medium roots; about 10 percent by volume angular serpentine stones; about 5 percent by volume angular serpentine fragments 1/4 to 1/2 inch across; neutral; clear wavy boundary.

A12—6 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky and moderate fine granular structure; hard, firm, sticky; common fine roots; 10 to 15 percent by volume angular serpentine fragments and plates; neutral; clear wavy boundary.

A13—14 to 18 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, very firm, very sticky; few fine and medium roots; few fine pores; about 15 percent by volume soft and cemented bodies of partially weathered serpentine 1/4 to 1 inch across; neutral; clear wavy boundary.

R—18 to 24 inches; light olive gray (5Y 6/2) strongly cemented and indurated serpentine bedrock that has irregular veins of accumulations of magnesium.

The solum ranges from 2 to 19 inches in thickness overlying serpentine bedrock. Coarse pebbles, cobbles, and flagstone make up 5 to 30 percent by volume of the soil. Reaction is slightly acid or neutral.

The A horizon is very dark grayish brown, dark grayish brown, or dark brown. The R layer is cemented and indurated serpentine bedrock tilted from 30 to as much as 60 degrees from horizontal. This layer outcrops to the surface in lateral distances of about 3 to 30 feet.

Spicewood series

The Spicewood series consists of moderately deep, well drained soils that formed in sediment weathered from siliceous limestone. Slopes range from 1 to 5 percent.

Typical pedon of Spicewood cobbly clay loam in Spicewood-Rock outcrop association, gently undulating, in range; from junction of U.S. Highway 281 and Mormon Mill county road in the town of Marble Falls, 1.45 miles northeast on Mormon Mill Road, and 30 feet north:

A1—0 to 8 inches; dark reddish brown (5YR 3/2) cobbly clay loam, dark reddish brown (5YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; common fine roots; about 30 percent by volume indurated lightweight porous angular siliceous cobbles; neutral; clear wavy boundary.

B21t—8 to 22 inches; dusky red (2.5YR 3/2) very cobbly clay; very dusky red (2.5YR 2/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine tubes; about 60 percent by volume indurated, lightweight, porous, siliceous, angular cobbles and pebbles that have reddish clay coatings; neutral; gradual wavy boundary.

B22t—22 to 38 inches; dark red (2.5YR 3/6) clay, dark red (2.5YR 3/6) moist; coarse strong blocky structure; extremely hard, extremely firm; few weakly cemented siliceous cobbles and pebbles; distinct intersecting slickensides and wedge shaped parallelepipeds tilted about 30 degrees from the horizontal; neutral; abrupt wavy boundary.

C—38 to 40 inches; weakly cemented pinkish white, lightweight, leached siliceous limestone; abrupt wavy boundary.

R—40 to 41 inches; gray and black indurated crystalline limestone.

The solum ranges from 25 to 40 inches in thickness. The mollic epipedon is 22 to 30 inches thick. Pebbles and cobbles on the surface range from 5 to 20 percent. Coarse fragments in the soil range from 30 to 60 percent by volume. Reaction of the soil is slightly acid or neutral.

The A horizon is dark reddish brown, reddish brown, or dark reddish gray cobbly clay loam or very cobbly clay loam. The Bt horizon is dusky red, reddish brown, dark reddish brown, red, or dark red. The clay content of the fine earth fraction ranges from 42 to 60 percent. The R layer is indurated fractured dolomite or porous lightweight sedimentary rock, a porous mass of filiform sponge residuum.

Tarpley series

The Tarpley series consists of shallow, well drained soils that formed in material weathered from indurated limestone. Slopes range from 1 to 8 percent.

Typical pedon of Tarpley stony clay in an area of Tarpley association, undulating, in range; from the town of Hye which is about 10 miles west of Johnson City, 0.5

mile west on U.S. Highway 290, 0.65 mile south on range trail, and 50 feet east:

A1—0 to 8 inches; dark reddish gray (5YR 4/2) stony clay, dark reddish brown (5YR 3/2) moist; moderate medium subangular blocky and moderate fine granular structure; very hard, very firm, sticky and plastic; limestone and chert fragments are on about 20 percent of surface and make up 20 percent by volume of the soil; about 45 percent clay; common fine and few medium roots; neutral; abrupt smooth boundary.

B2t—8 to 15 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm, sticky and plastic; about 70 percent clay; few fine roots; vertical cracks filled with soil from upper layer; neutral; abrupt smooth boundary.

R—15 to 16 inches; indurated limestone bedrock, fractured and rough on upper surface.

The solum ranges from 13 to 20 inches in thickness. The mollic epipedon ranges from 7 inches thick in places, to the entire thickness of the solum in other places. Stones are on as much as 25 percent of the surface, and limestone and chert pebbles, cobbles, and stones make up 15 to 20 percent by volume of the soil. When the soil is dry, cracks extend to the limestone bedrock. These cracks, which are up to 3/4 inch wide at the surface are 1/8 to 1/4 inch wide at the bottom of the soil. Reaction of the soil is neutral or mildly alkaline.

The A1 horizon is very dark grayish brown, dark reddish gray, dark reddish brown, reddish brown, or dark brown clay or clay loam or their stony analogs. The Bt horizon is reddish brown clay or stony clay that has about 60 to 80 percent clay.

Throck variant

The Throck variant consists of deep, well drained soils that formed in material weathered from clayey marl and shaly clay. Slopes range from 1 to 3 percent.

Typical pedon of Throck variant silty clay loam, 1 to 3 percent slopes, in cultivated field; from intersection of U.S. Highway 281 and Ranch Road 1431 in the town of Marble Falls, 4.2 miles east on Ranch Road 1431, and 60 feet north:

Ap—0 to 8 inches; light yellowish brown (2.5Y 6/4) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; hard, firm, sticky; common fine roots; common fine tubes and pores; calcareous; moderately alkaline; abrupt smooth boundary.

B21—8 to 17 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky; common fine roots; common fine and medium pores; common insect casts and burrows; 2 inch thick discontinuous stone line that has 30 to 40 percent sandstone and limestone pebbles and cobbles; calcareous; moderately alkaline; clear wavy boundary.

B22—17 to 32 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium angular blocky structure; hard, friable, sticky; few very fine roots; common fine tubes and pores; common medium worm casts and burrows; few fine soft bodies of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

B23ca—32 to 41 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium angular blocky structure; hard, friable, sticky; many fine tubes and pores; many worm casts and burrows; numerous films and threads of calcium carbonate; 8 to 10 percent by volume soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

IIB24ca—41 to 80 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, sticky; common fine and medium tubes and pores; 10 to 15 percent by volume limestone pebbles; calcareous; moderately alkaline.

The solum ranges from 21 to 80 inches in thickness. The A horizon is yellowish brown or light olive brown. The B horizon is grayish brown, light olive brown, brown, olive, pale olive, or light yellowish brown. The IIB24ca horizon is pale olive or light yellowish brown shaly clay or sandy clay loam. The B horizon has concretions of calcium carbonate. Some pedons contain gypsum and weathered shale.

Voca series

The Voca series consists of deep, well drained gravelly soils that formed in material weathered from fragmented granite. Slopes range from 1 to 5 percent.

Typical pedon of Voca gravelly sandy loam in an area of Voca association, gently undulating, in range; from the town of Sandy which is about 10 miles northwest of Johnson City, 3.3 miles northwest on Ranch Road 1323, 0.25 mile north on county road, and 25 feet east:

A1—0 to 8 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine granular; very hard, very friable; many fine roots; 20 percent by volume angular quartz and feldspar pebbles; neutral; clear wavy boundary.

B21t—8 to 19 inches; dark reddish brown (2.5YR 3/4) gravelly clay, dark reddish brown (2.5YR 3/4) moist;

moderate medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; common fine pores; 29 percent by volume angular feldspar pebbles; slightly acid; gradual wavy boundary.

B22t—19 to 28 inches; yellowish red (5YR 5/6) gravelly clay, yellowish red (5YR 4/6) moist; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; extremely hard, very firm, very sticky and plastic; 30 percent by volume angular feldspar pebbles; slightly acid; gradual wavy boundary.

B23t—28 to 48 inches; red (2.5YR 4/6) very gravelly clay, red (2.5YR 4/6) moist; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; extremely hard, very firm; 38 percent by volume weathered granite coated with clay from upper layer; slightly acid; gradual wavy boundary.

Cr—48 to 80 inches; about 95 percent feldspar, quartz, and mica with 5 percent reddish brown (5YR 5/4) clay; slightly acid.

The solum ranges from 40 to 60 inches in thickness. Coarse fragments that are mostly 15 millimeters in size make up 20 to 40 percent by volume of the soil content. A few cobbles are on the surface and in the soil. The cation exchange capacity ranges from 6 to 13 milliequivalents per 100 grams of soil. The base saturation ranges from 76 to 87 percent. Reaction of the soil is neutral or slightly acid.

The A horizon is dark yellowish brown, brown, reddish brown, or strong brown gravelly sandy loam or gravelly loamy sand. The Bt horizon is yellowish red, reddish brown, dark reddish brown, or red gravelly clay or very gravelly clay. The Cr horizon is mixed granite, feldspar, quartz, mica, and clay.

Weswood series

The Weswood series consists of deep, well drained soils that formed in alluvium along the Colorado and Lampasas Rivers. The soils are moderately alkaline. Slopes range from 0 to 1 percent.

Typical pedon of Weswood silt loam; from point where paved road crosses Backbone Creek in Marble Falls City Park, 150 feet west, and 15 feet south:

A11—0 to 7 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores and worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21—7 to 30 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores and worm casts; common fine threads and films of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B22—30 to 48 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few thin strata of very fine sandy loam; common very fine roots; common worm casts; calcareous; moderately alkaline; diffuse smooth boundary.

C—48 to 63 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure in a few strata, massive in other strata; hard, friable; common fine threads of calcium carbonate; thin strata of fine sandy loam evident; calcareous; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. The A horizon is brown. Where the moist value is less than 3.5, it makes up less than one-third of the solum thickness. The B horizon is reddish brown, light reddish brown, yellowish red, reddish yellow, or brown silty clay loam or silt loam. The C horizon is reddish yellow, yellowish red, light reddish brown, or pink silt loam, loam, or silty clay loam.

Classification of the soils

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 "Soil taxonomy" (*5*).

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 classification is based on 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, 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 as classes in the system. 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 Aquent (*Aqu*, meaning water, 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. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

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. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

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, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section five factors of soil formation are described and related to the soils in the survey area. The processes of soil formation are also described.

Factors of soil formation

Soil is produced by the action of soil forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil are determined by the composition of the parent material, the climate under which the soil material accumulated and weathered, 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.

Climate and vegetation are the active factors of soil genesis. They alter the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are modified by relief. The composition of the parent material also affects the kind of profile that is formed and in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil profile. Generally, a long time is required for the development of distinct horizons.

The type of parent material is probably the most important factor in soil genesis and in determining the characteristics of the mature soil. Climate is probably the next most important factor in soil formation. Topography, living organisms, and time all interact with climate on the parent material to form the soil. All of these factors are closely interrelated, however, and any one of them is conditioned by the other four.

Parent material

Parent material is the unconsolidated mineral or organic matter from which the soil is formed. It directly affects the texture, reaction, and rate of formation of soil. Because they weather faster, unconsolidated or soft materials form soil more rapidly than hard or consolidated materials. Some examples of parent materials are limestone, granite, schist, gneiss, sandstone, serpentine, and terrestrial and alluvial sediments.

Climate

Climate is the total of all atmospheric influences. Temperature, wind, moisture, pressure, and evaporation act upon a region to change the nature of land forms, soils, vegetation, and land use. The climate of Blanco and Burnet Counties is dry subhumid. Periods of heavy rainfall of high intensity alternate with periods of major and minor drought. In past ages, the wet climate and the recession of the Cretaceous Sea influenced the older soils by the deposition of parent material in the valleys and in the leaching of carbonates and illuviation of clays. In later years, precipitation has been limited, and the younger soils have not been leached of carbonates. These soils are calcareous in the surface layer.

Living organisms

Vegetation, earthworms, insects, small rodents, and animals contribute to the formation of soils. In the mixed grass prairie, large amounts of organic matter and organic acids help to weather the parent material and reduce erosion. When these grasses and trees die, the decomposing roots leave a network of channels and pores

which increase the passage of air and water through the soil. Earthworms burrow into the soil and add to this movement of air and water. The decayed roots provide food for bacteria. In places, small rodents, insects, and animals disturb the soil by burrowing and killing the vegetation.

Man should also be considered in the formation of soils. By plowing, grazing, and burning off the land, he has been both detrimental and beneficial to the soil. Plowing and cultivating the soil and overgrazing the range have increased runoff and accelerated erosion. Burning the rangeland and crop residues have decreased the number of organisms in the soil, depleted the organic matter, and killed the vegetation. Poor tillage methods have reduced water intake, and use of heavy machinery has compacted the soil. Man has been beneficial to the soil by controlling erosion, by irrigating, and by planting soil improving crops.

Topography

Topography influences soil genesis by its effect on drainage, erosion, plant cover, and soil temperature. The steep Brackett soil absorbs less moisture, is more eroded, and has less development than the more level, deeper Pedernales soil. The Pedernales soil receives additional water, and carbonates are leached to depths of below 28 inches. The gently sloping Luckenbach soil has a dark surface horizon which is at least one-third the thickness of the solum. Because soils on steep slopes facing north and northwest receive less direct sunlight and lose less moisture, they generally produce more vegetation and have darker surface horizons than those soils on slopes facing south and southeast.

Time

The time in which climate, living organisms, and topography have acted upon the parent material affects the kind of soil formed. Soils that have undergone a process of weathering for a long period of time and have parent material that weathers easily have a horizon of clay accumulation (an argillic horizon) and are nearing equilibrium with their environment. These soils are classified as Alfisols or Mollisols. Soils considered as young or immature do not have clearly defined horizons and are not in equilibrium with their environment. They are classified an Entisols.

Some soils have formed in a very short period of time. For example, the Oakalla soil, which has a very simple genesis, formed in recently deposited alluvial sediment. The Click soil, however, which formed from granite, may have taken as long as 60 million years to form, because the granite parent material resists weathering.

Geology

The rocks in Blanco and Burnet Counties range in date of origin from the Precambrian Era to the Cenozoic Era. The counties are on the eastern and southeastern edge of the Llano Uplift. This Precambrian Formation, resulting from an upward bulging of the earth, caused rocks to be brought to the surface that normally were covered by several miles of younger rocks. Geologic maps of the area show that these rocks, recrystallized as a result of high pressure and temperature during deep burial beneath other rocks, are perhaps a billion years old. Local melting produced granite and various other types of igneous rocks.

Rocks of the Precambrian Era in Blanco and Burnet Counties are Town Mountain Granite, the parent material of Click, Keese, and Voca soils; Packsaddle Schist, Katemcy and Ligon soils; and Coal Creek Separation, Renick soils.

Rocks of the Paleozoic Era are Hickory and Lion Mountain Sandstones, which produced the Hye, Nebgen, and Oben soils; and Cap Mountain Limestone and Ellenberger Limestone, the Eckert, Harper, and Spicewood soils.

Rocks of the Mesozoic Era are Edwards Limestone, the parent material of Anhalt, Eckrant, Hensley, Purves, and Tarpley soils; Glen Rose Limestone, the Bolar, Brackett, and Doss soils; and outcrop of the Travis Peak Formation.

The materials of the Cenozoic Era from which soils have formed are mainly of the Pleistocene and Recent Epochs. The Krum and Lewisville soils formed in old outwash from limestone; the Heaton soil, in old outwash from sandstone; and the Luckenbach and Pedernales soils, in ancient materials derived from mixed limestone and sandstone. The Oakalla and Weswood soils formed in recent alluvium from streams.

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(4) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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.

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
Moderate	6 to 9
High	More than 9

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.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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.

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.

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.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

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."

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Favorable. Favorable soil features for the specified use.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

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.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as pro-

tection 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.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

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

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.

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.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. 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.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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 characterisitc that affects management. These differencees are too small to justify separate series.

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.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

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.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

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.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

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.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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* (0.005 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.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

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).

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."

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.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, 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.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

Figure 1.—Profile of Aledo gravelly clay loam. The underlying material is strongly cemented limestone bedrock.

Figure 2.—Profile of Anhalt clay, 0 to 1 percent slopes. This clayey soil has deep, wide cracks when it is dry.

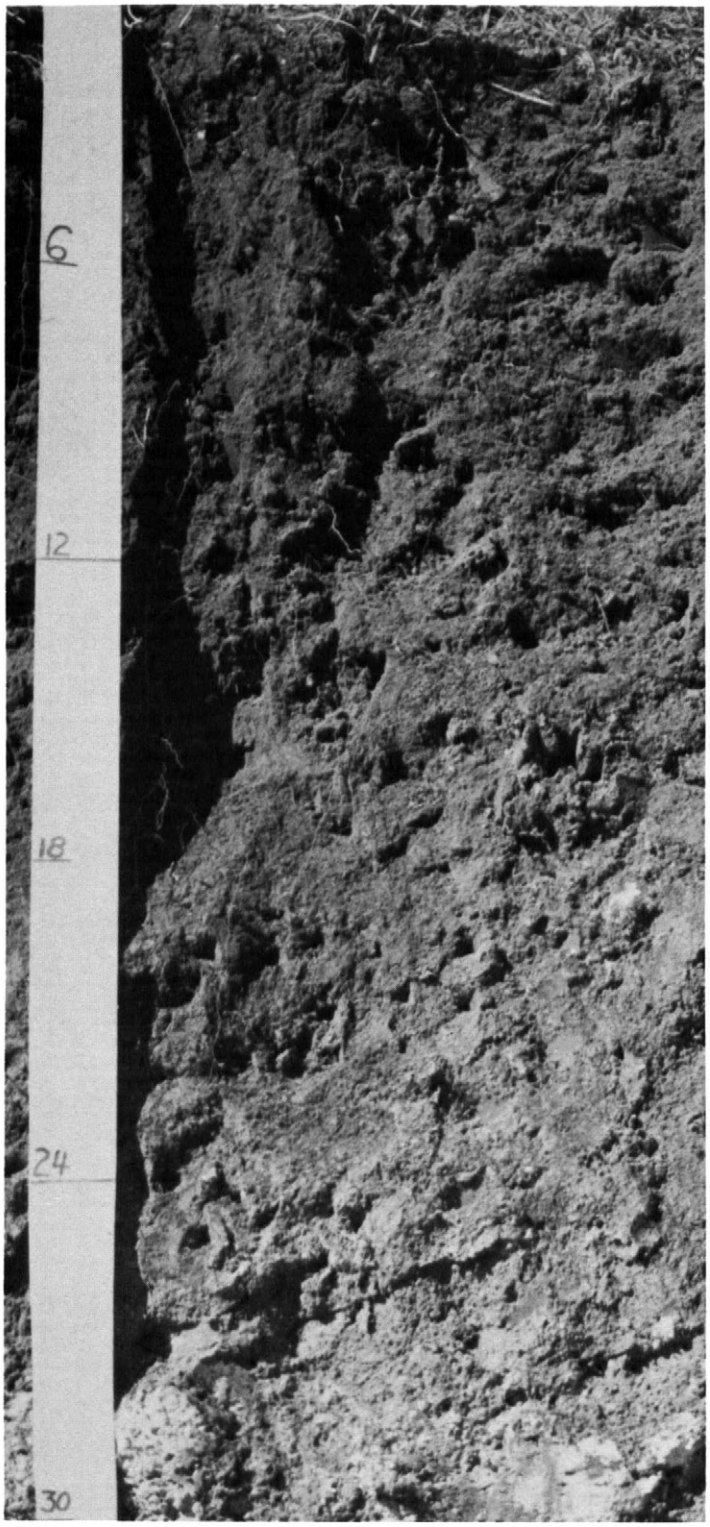

Figure 3.—Profile of Bolar clay loam, 1 to 3 percent slopes. Limestone and marl are at a depth of about 33 inches.

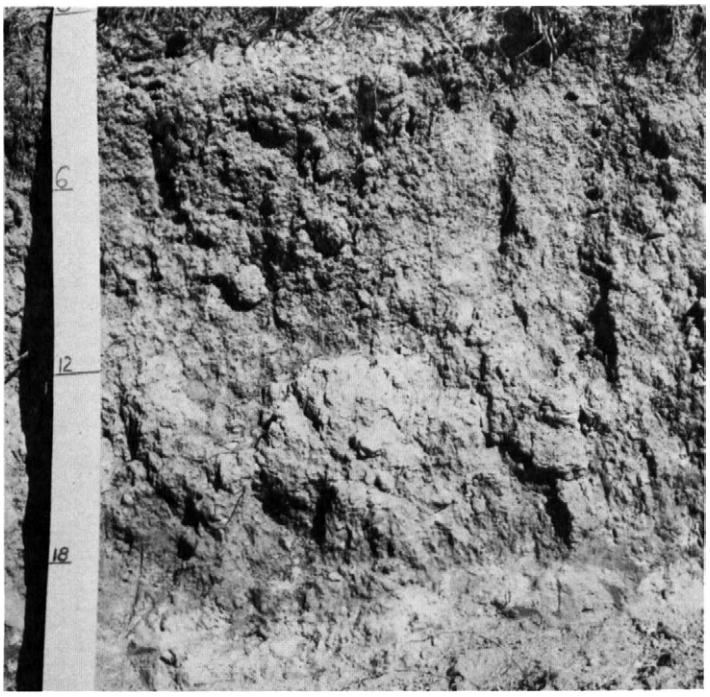

Figure 4.—Profile of Brackett clay loam. Cretaceous limestone and marl are at a depth of about 18 inches.

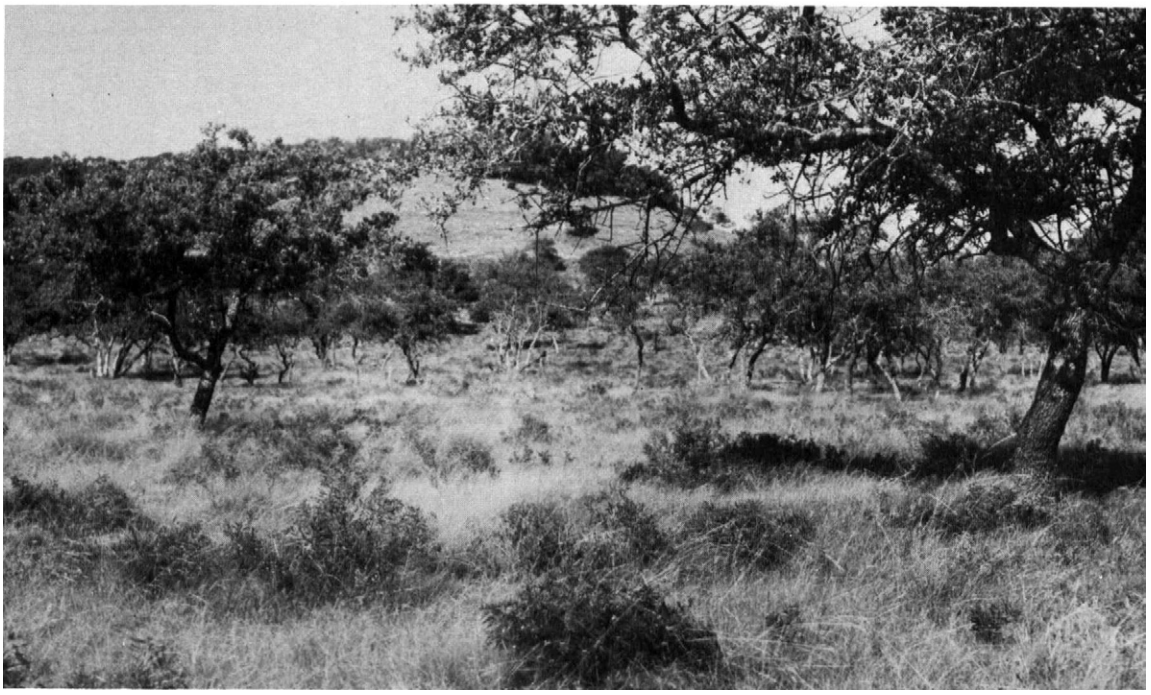

Figure 5.—In the foreground is Brackett clay loam in Brackett association, undulating. This soil in the Adobe range site provides excellent food and cover for wildlife.

Figure 6.—A landscape that has Brackett-Real association, hilly in the background.

Figure 7.—Profile of Doss silty clay, 1 to 5 percent slopes. Caliche is at a depth of 17 inches.

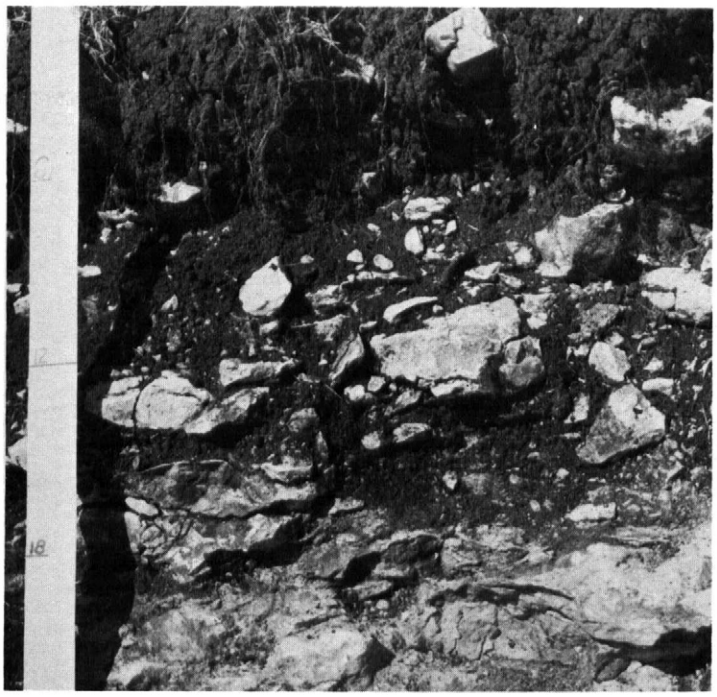

Figure 8.—Profile of Eckrant very cobbly clay. This shallow soil has many cobbles on the surface. It is underlain by indurated limestone bedrock.

Figure 9.—Profile of Hensley stony loam. Limestone bedrock is at a depth of 18 inches.

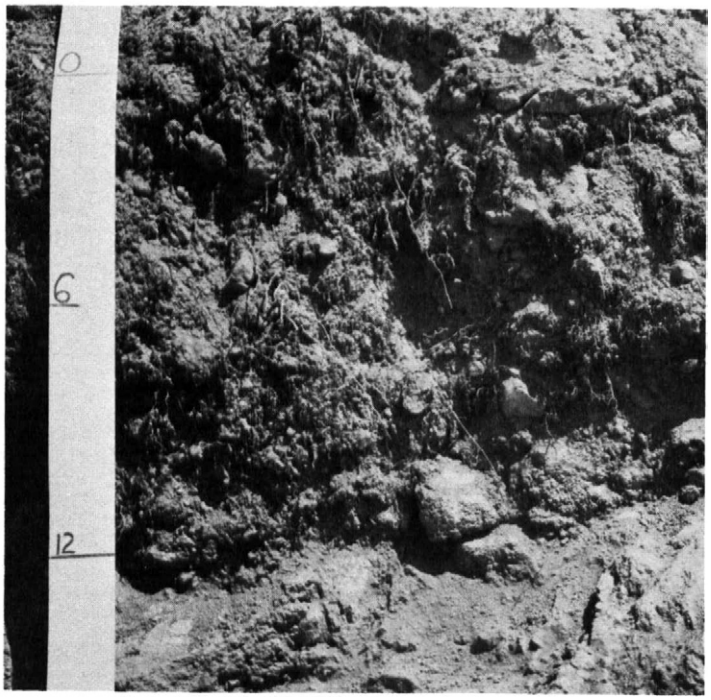

Figure 10.—Profile of Keese gravelly sandy loam. Granite bedrock is at a depth of about 14 inches.

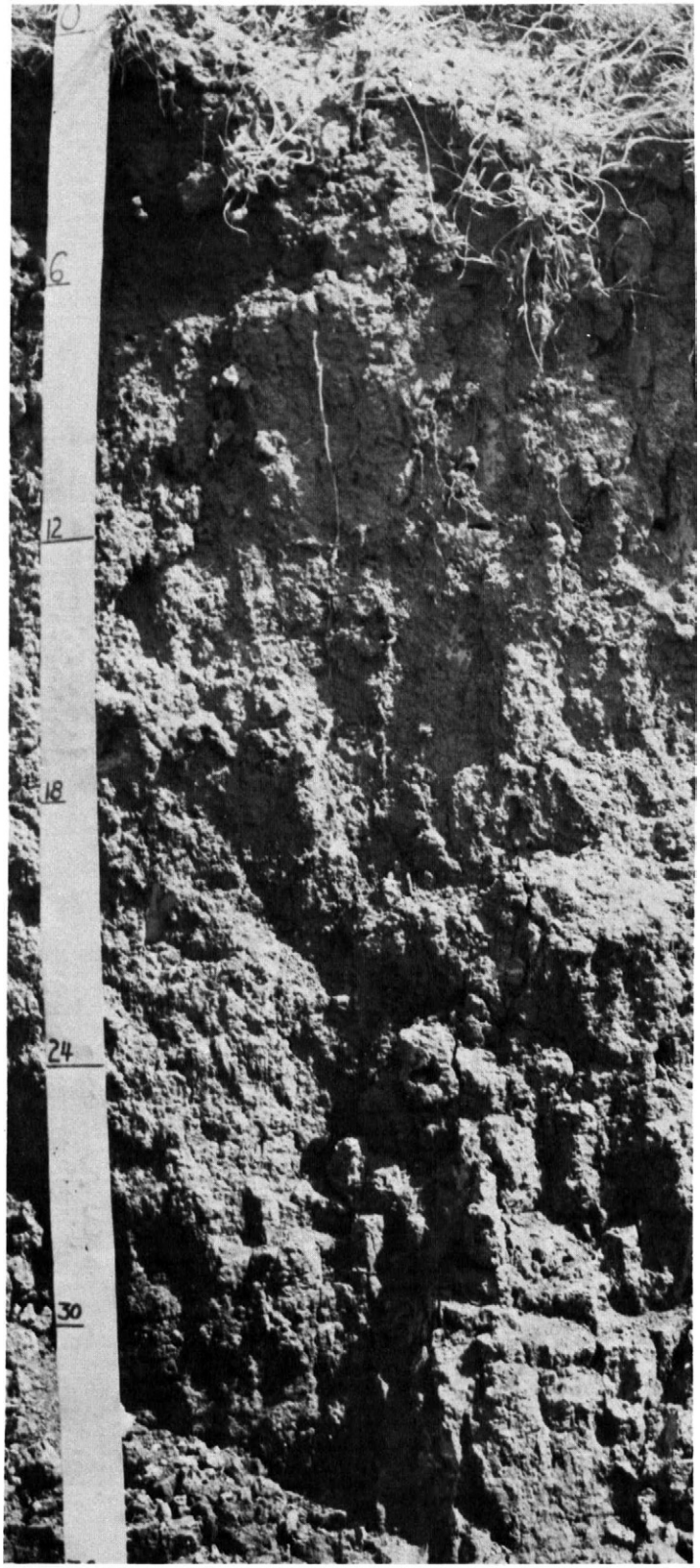

Figure 11.—Profile of Krum clay, 1 to 3 percent slopes. This deep, clayey, slowly permeable soil has cracks when it is dry.

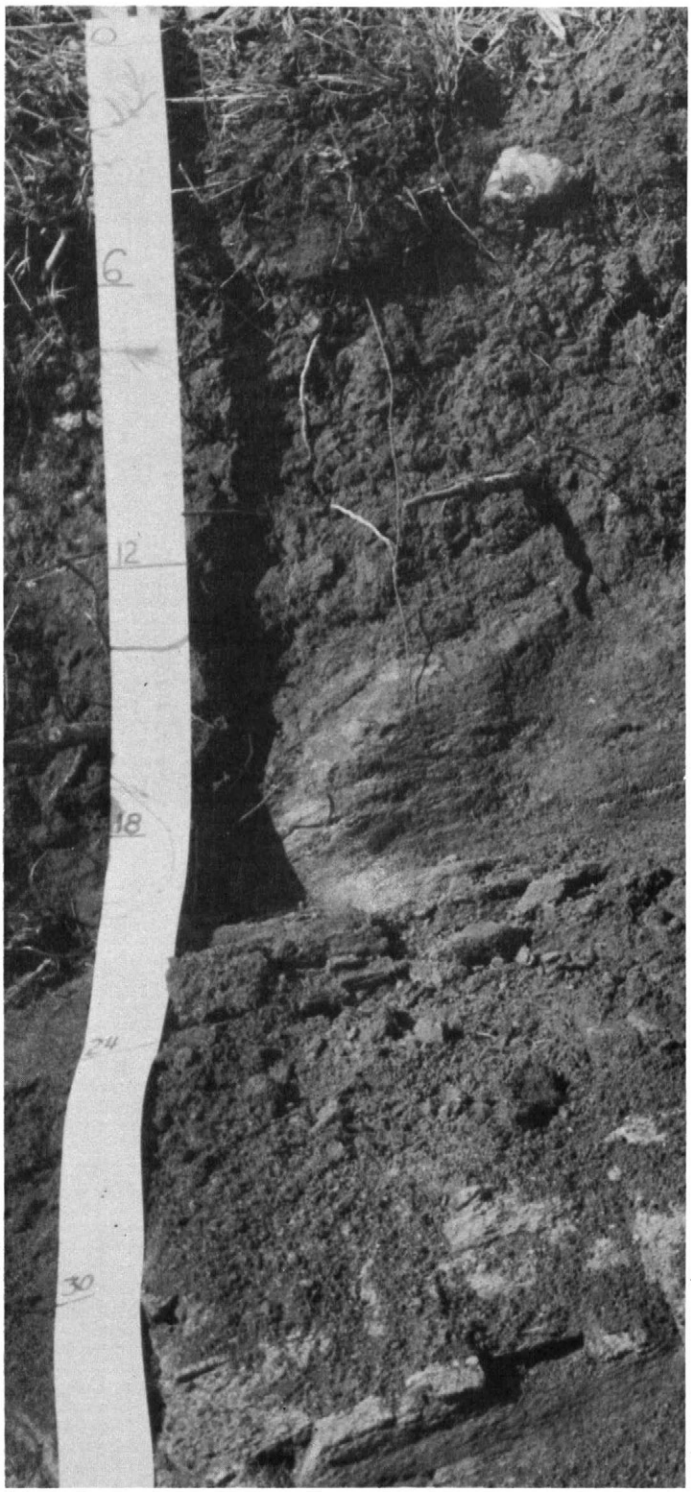

Figure 12.—Profile of Ligon clay loam. The underlying material is cemented, fractured, weathered schist.

Figure 13.—Profile of Nebgen fine sandy loam. This soil contains a few sandstone fragments and is underlain by cemented sandstone plates.

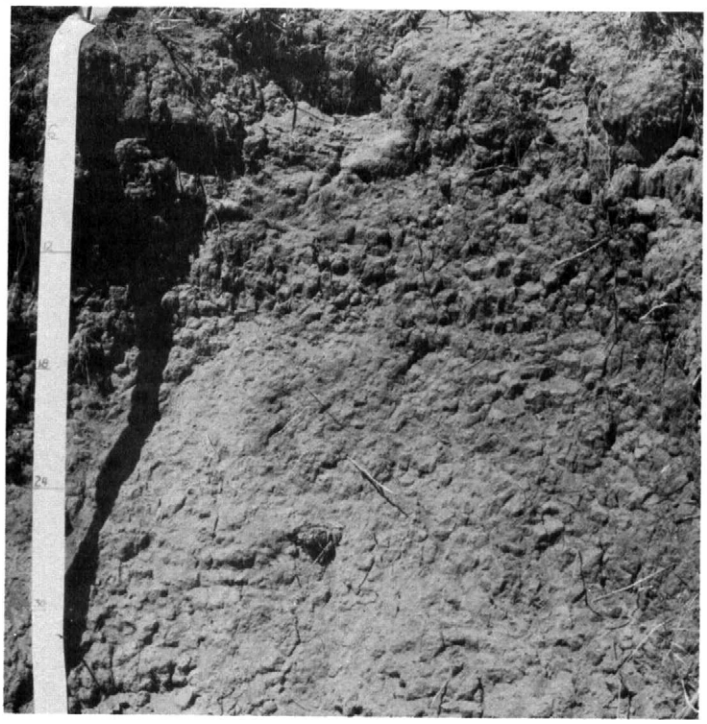

Figure 14.—Profile of Pedernales fine sandy loam, 1 to 3 percent slopes. This soil has a subsoil of sandy clay.

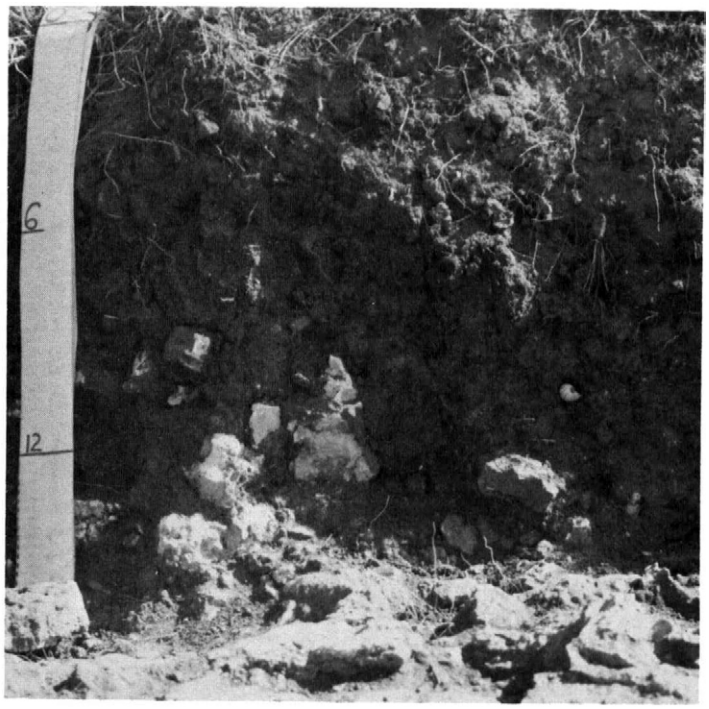

Figure 15.—Profile of Purves gravelly clay, 1 to 3 percent slopes. Limestone bedrock is at a depth of 14 inches.

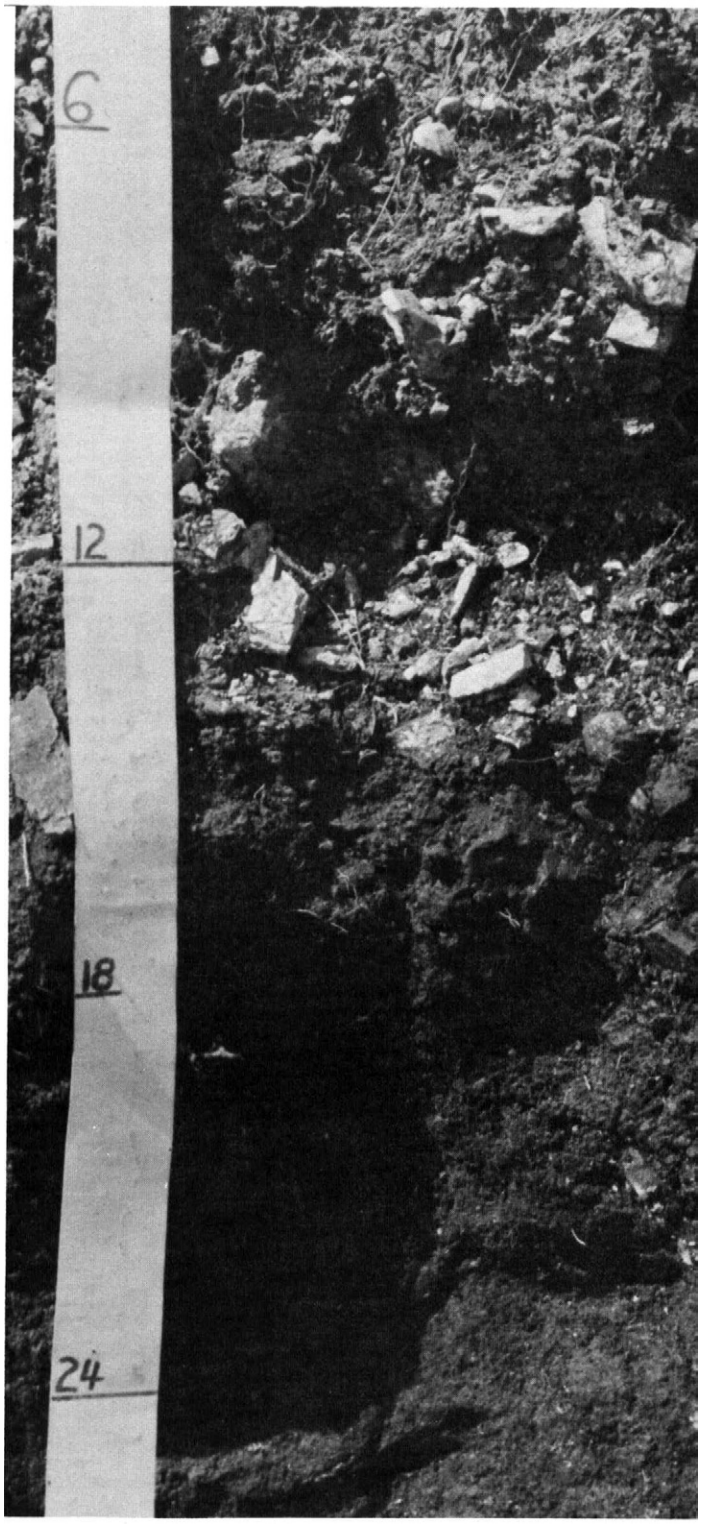

Figure 16.—Profile of Spicewood cobbly clay loam. The surface layer and upper part of the subsoil contain limestone fragments.

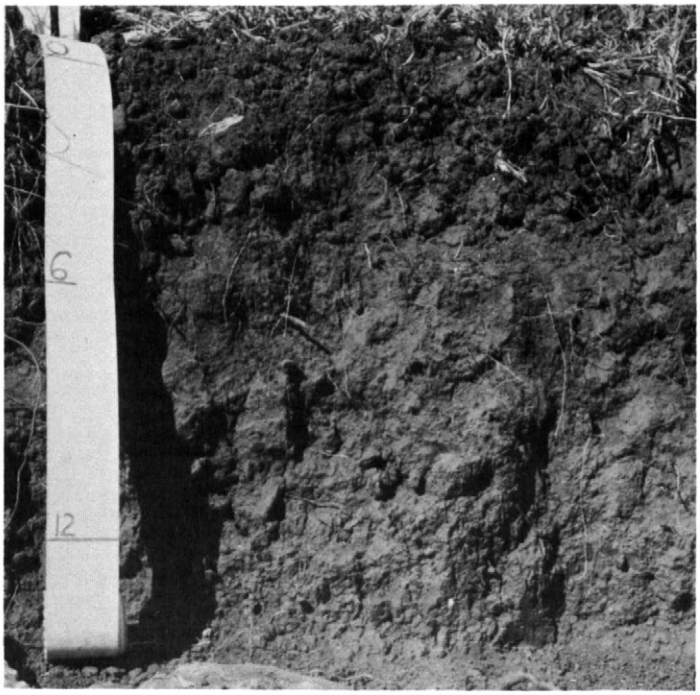

Figure 17.—Profile of Tarpley clay. Limestone bedrock is at a depth of about 14 inches.

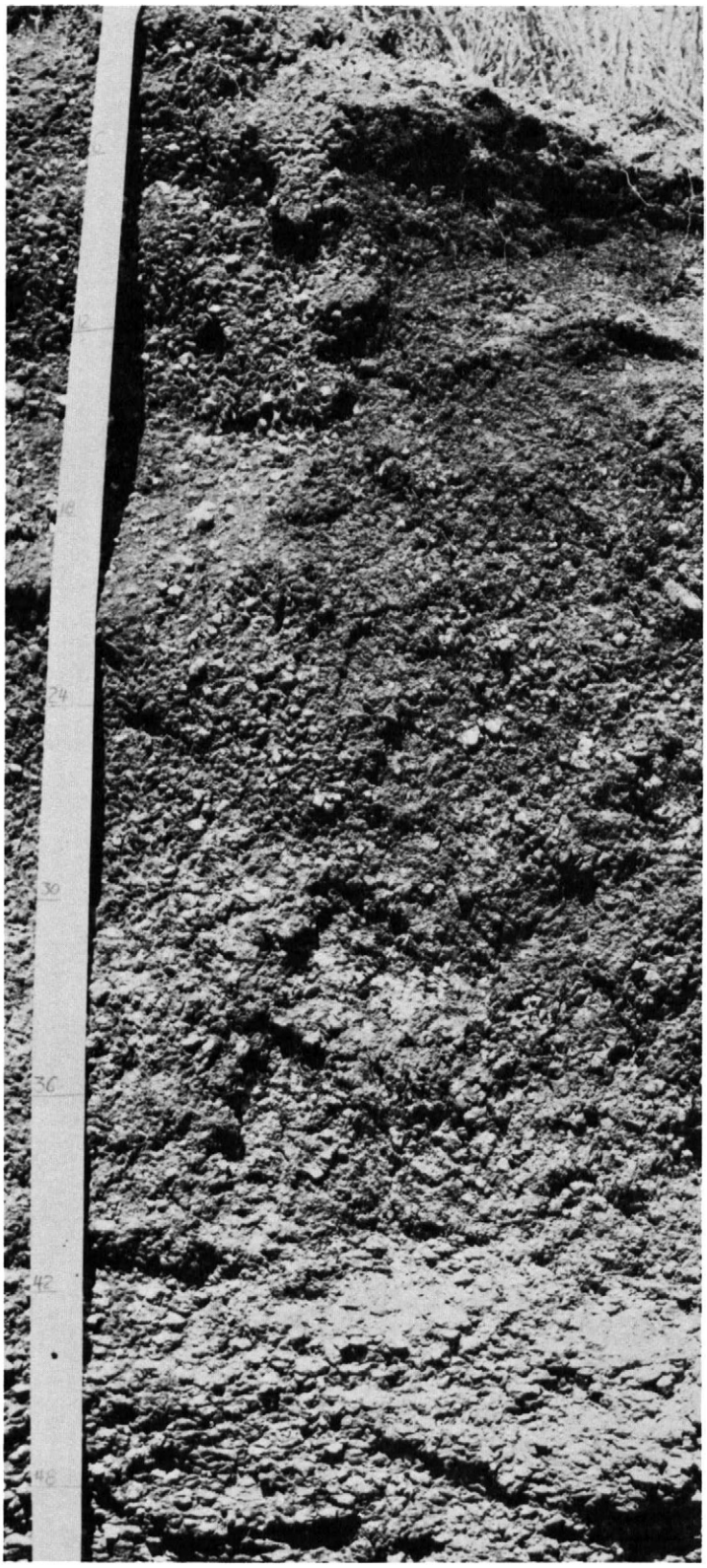

Figure 18.—Profile of Voca gravelly sandy loam. This deep soil has a subsoil of gravelly clay. The underlying material is weathered and fragmented granite.

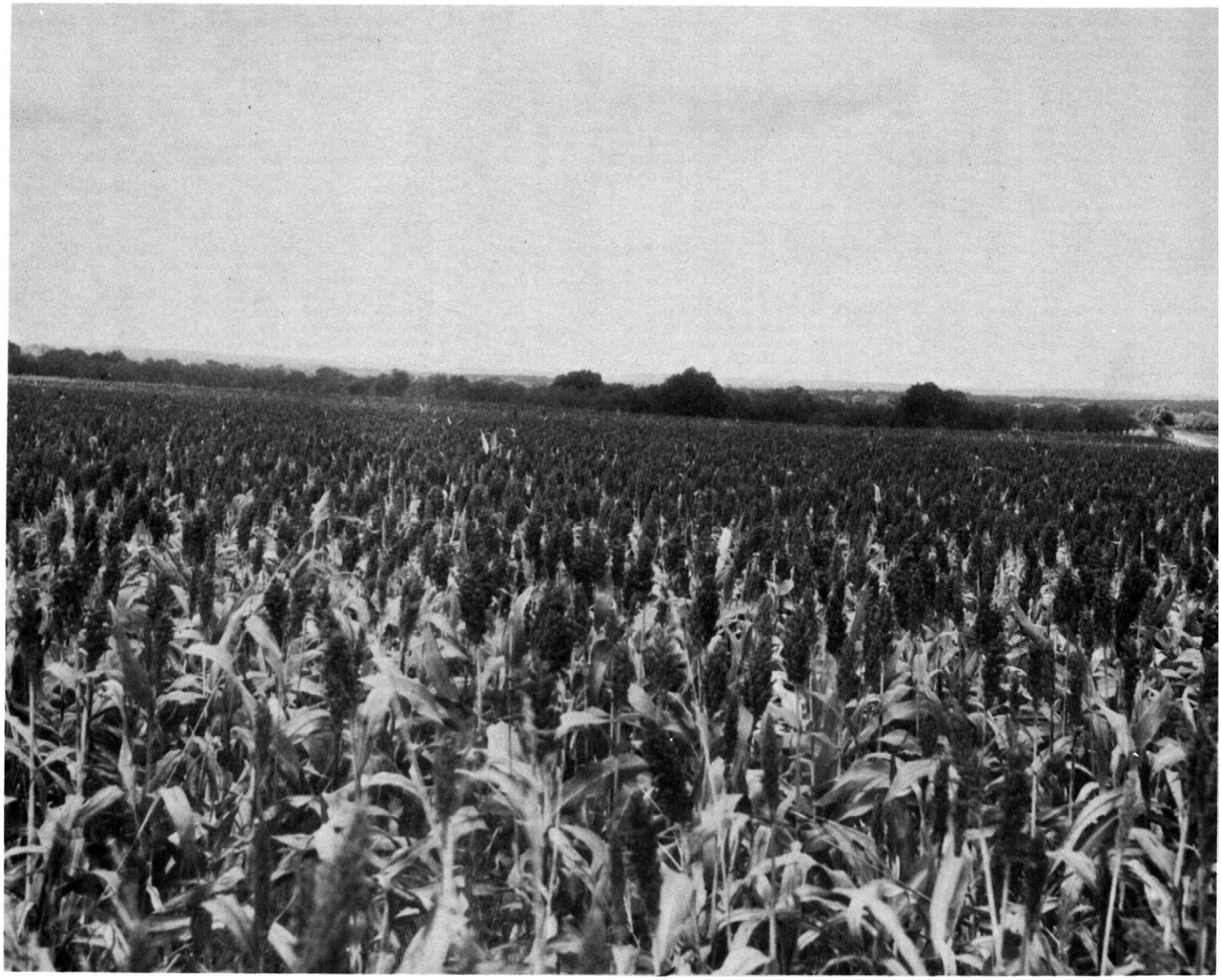

Figure 19.—Grain sorghum on Luckenbach clay loam, 1 to 3 percent slopes. This soil is one of the most productive in the survey area.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data were recorded in the period 1941-70 at Blanco, Texas. An asterisk in a column indicates less than one half. TR means trace.]

Month	Temperature					Average number of growing degree days [1]	Precipitation				Average number of days			
									Snow, Sleet			Temperatures		
												Maximum		Minimum
	Average daily maximum	Average daily minimum	Average	Record highest	Record lowest		Average	Greatest daily	Average	Maximum monthly	Precipitation .10 inch or more	90° and above	32° and below	32° and below
	°F	°F	°F	°F	°F	Units	In	In	In	In		°F	°F	°F
January	60.3	34.0	47.2	91	-6	595	2.12	3.21	0.6	11.0	4	0	1	15
February	63.6	37.3	50.5	91	-5	445	3.00	4.65	0.4	5.0	5	*	*	11
March	70.8	42.2	56.5	99	15	292	2.10	2.59	0.1	4.0	4	*	0	6
April	79.1	53.2	66.2	103	29	76	3.54	8.12	0	0	5	1	0	*
May	85.1	60.7	72.9	103	38	15	3.98	8.13	0	0	6	8	0	0
June	92.2	67.7	80.0	103	49	1	2.92	4.33	0	0	4	22	0	0
July	96.0	69.6	82.8	109	56	0	1.98	4.21	0	0	2	28	0	0
August	96.6	68.7	82.7	109	53	0	2.21	5.05	0	0	3	28	0	0
September	90.0	63.3	76.7	106	39	4	4.65	17.47	0	0	6	17	0	0
October	81.5	53.4	67.5	99	28	73	3.60	6.88	0	0	4	3	0	*
November	70.2	42.1	56.2	95	17	308	2.09	2.91	0.2	4.0	4	*	*	6
December	63.3	36.1	49.7	91	12	446	2.20	3.50	TR	TR	4	0	*	13
Years:														
Average	79.1	52.4	65.8								51	107	1	51
Extreme				109	-6									
Total						2255	34.39	17.47	1.3	11.0				

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum daily temperatures, dividing by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP FOR SPECIFIED USES

Soil unit	Extent of area	Cultivated farm crops	Rangeland	Urban uses	Recreation areas	Sanitary facilities
1. Brackett-Purves-Doss---	55	Low: rooting depth, small stones, slope.	Low: rooting depth, low available water capacity.	Low: depth to rock, slope.	Medium: percs slowly, slope.	Low: depth to rock, percs slowly.
2. Hensley-Eckrant--------	11	Low: rooting depth, small stones, low available water capacity.	Medium: rooting depth, low available water capacity, slope.	Low: depth to rock, stoniness, corrosivity.	Low: depth to rock, too clayey, small stones, percs slowly, slope.	Low: depth to rock.
3. Eckrant-Brackett-------	4	Low: rooting depth, small stones, low available water capacity.	Medium: rooting depth, low available water capacity, slope.	Low: depth to rock, slope.	Low: depth to rock, slope, percs slowly, too clayey.	Low: depth to rock, slope, percs slowly.
4. Hensley-Tarpley--------	4	Low: rooting depth, small stones.	Medium: rooting depth, low available water capacity.	Low: depth to rock, corrosivity, shrink-swell.	Low: depth to rock, too clayey, stoniness.	Low: depth to rock.
5. Krum-Lewisville--------	7	High.	High.	Medium: too clayey, shrink-swell, percs slowly.	Medium: too clayey, percs slowly.	Medium: too clayey, percs slowly.
6. Oakalla-Weswood--------	2	High.	Medium: low available water capacity, shading from trees.	Low: floods.	Medium: too clayey, floods, percs slowly.	Medium: floods.
7. Nebgen-Eckert-Ligon----	5	Low: rooting depth, low available water capacity, slope.	Low: rooting depth, very low available water capacity.	Low: depth to rock, stoniness.	Medium: depth to rock, small stones.	Low: depth to rock.
8. Voca-Click-------------	4	Low: erodes easily, low available water capacity.	Low: low available water capacity.	Medium: depth to rock, too clayey.	Medium: small stones, percs slowly.	Low: depth to rock, fast intake.
9. Pedernales-Luckenbach--	3	Medium: erodes easily, rooting depth, percs slowly.	Medium: slope.	Medium: shrink-swell, low strength, corrosivity, too clayey, percs slowly.	Medium: too clayey, percs slowly.	Low: too clayey, percs slowly.
10. Keese-Nebgen----------	2	Low: rooting depth, very low available water capacity, slope, stoniness.	Low: rooting depth, very low available water capacity, slope.	Low: depth to rock, slope.	Medium: depth to rock, slope, rockiness.	Low: depth to rock, slope, rockiness.
11. Bolar-Doss------------	3	Medium: low to medium available water capacity, rooting depth.	Medium: low to medium available water capacity, rooting depth.	Medium: depth to rock, shrink-swell, corrosivity.	Medium: depth to rock, too clayey.	Low: depth to rock, too clayey, percs slowly.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Blanco County	Burnet County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
1	Aledo association, undulating	0	16,326	16,326	1.5
2	Anhalt clay, 0 to 1 percent slopes	1,370	748	2,118	0.2
3	Anhalt clay, 1 to 3 percent slopes	2,300	1,086	3,386	0.3
4	Bolar clay loam, 1 to 3 percent slopes	5,370	31,984	37,354	3.4
5	Bolar clay loam, 3 to 5 percent slopes	4,870	4,208	9,078	0.8
6	Brackett association, undulating	76,950	106,716	183,666	16.5
7	Brackett-Real association, hilly	115,960	45,937	161,897	14.5
8	Click gravelly sandy loam, 1 to 5 percent slopes	1,155	3,725	4,880	0.4
9	Doss silty clay, 1 to 5 percent slopes	30,395	31,578	61,973	5.6
10	Eckert-Rock outcrop association, rolling	21,375	2,814	24,189	2.2
11	Eckrant association, undulating	12,705	57,686	70,391	6.3
12	Eckrant-Rock outcrop association, hilly	285	16,120	16,405	1.5
13	Harper-Rock outcrop association, undulating	3,060	6,062	9,122	0.8
14	Heaton loamy fine sand, 1 to 5 percent slopes	465	2,305	2,770	0.2
15	Hensley loam, 1 to 3 percent slopes	1,455	1,879	3,334	0.3
16	Hensley loam, 3 to 5 percent slopes	1,105	672	1,777	0.2
17	Hensley association, undulating	35,790	57,253	93,043	8.4
18	Houston Black clay, 0 to 1 percent slopes	0	1,392	1,392	0.1
19	Houston Black clay, 1 to 3 percent slopes	0	1,854	1,854	0.2
20	Hye fine sandy loam, 1 to 5 percent slopes	2,830	5,287	8,117	0.7
21	Karnes loam, 1 to 3 percent slopes	2,235	884	3,119	0.3
22	Katemcy loam, 1 to 5 percent slopes	2,365	0	2,365	0.2
23	Keese-Rock outcrop association, rolling	2,860	15,736	18,596	1.7
24	Krum clay, 1 to 3 percent slopes	21,025	18,198	39,223	3.5
25	Krum clay, 3 to 5 percent slopes	16,425	3,053	19,478	1.7
26	Lewisville clay loam, 0 to 1 percent slopes	2,910	2,499	5,409	0.5
27	Lewisville clay loam, 1 to 3 percent slopes	2,885	4,801	7,686	0.7
28	Ligon-Rock outcrop association, undulating	3,230	3,470	6,700	0.6
29	Luckenbach clay loam, 1 to 3 percent slopes	1,435	1,903	3,338	0.3
30	Nebgen-Oben-Rock outcrop association, rolling	16,745	19,661	36,406	3.3
31	Oakalla loam	0	1,931	1,931	0.2
32	Oakalla silty clay loam	1,835	7,437	9,272	0.8
33	Oben fine sandy loam, 1 to 5 percent slopes	2,650	0	2,650	0.2
34	Owens association, hilly	0	7,699	7,699	0.7
35	Pedernales fine sandy loam, 1 to 3 percent slopes	5,460	5,815	11,275	1.0
36	Pedernales fine sandy loam, 3 to 5 percent slopes	7,140	1,227	8,367	0.8
37	Purves gravelly clay, 1 to 3 percent slopes	0	15,972	15,972	1.4
38	Purves association, undulating	33,520	77,383	110,903	9.9
39	Renick stony clay loam, 5 to 12 percent slopes	735	0	735	0.1
40	Spicewood-Rock outcrop association, gently undulating	0	6,693	6,693	0.6
41	Tarpley clay, 1 to 3 percent slopes	3,620	2,703	6,323	0.6
42	Tarpley association, undulating	13,135	16,154	29,289	2.6
43	Throck Variant, silty clay loam, 1 to 3 percent slopes	0	1,455	1,455	0.1
44	Voca association, gently undulating	2,510	24,596	27,106	2.4
45	Weswood silt loam	0	2,218	2,218	0.2
	Water (in areas of more than 40 acres)	0	16,960	16,960	1.5
	Total	460,160	654,080	1,114,240	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Grain sorghum	Oats	Wheat	Pasture
	Bu	Bu	Bu	AUM*
1**--Aledo	---	---	---	---
2--Anhalt	45	50	---	8
3--Anhalt	45	50	---	8
4--Bolar	40	40	---	---
5--Bolar	35	35	---	---
6**--Brackett	---	20	10	---
7**:				
Brackett	---	---	---	---
Real	---	---	---	---
8--Click	---	---	---	---
9--Doss	---	60	20	4.0
10**:				
Eckert	---	---	---	---
Rock outcrop.				
11**--Eckrant	---	---	---	---
12**:				
Eckrant	---	---	---	---
Rock outcrop.				
13**:				
Harper	---	---	---	---
Rock outcrop.				
14--Heaton	40	35	---	---
15--Hensley	25	40	20	---
16--Hensley	20	35	15	---
17**--Hensley	---	---	---	---
18--Houston Black	90	70	30	---
19--Houston Black	85	70	30	---

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Grain sorghum	Oats	Wheat	Pasture
	Bu	Bu	Bu	AUM*
20---------- Hye	45	---	---	---
21---------- Karnes	25	30	---	---
22---------- Katemcy	20	---	15	2.5
23**: Keese----------	---	---	---	---
Rock outcrop.				
24---------- Krum	70	70	---	8.0
25---------- Krum	65	50	---	6.0
26---------- Lewisville	85	70	---	---
27---------- Lewisville	80	70	---	---
28**: Ligon----------	---	---	---	2.0
Rock outcrop.				
29---------- Luckenbach	60	50	30	---
30**: Nebgen----------	---	---	---	---
Oben----------	---	---	---	---
Rock outcrop.				
31, 32---------- Oakalla	65	60	25	6.5
33---------- Oben	---	30	---	3.0
34**: Owens----------	---	---	---	---
35---------- Pedernales	35	60	25	4
36---------- Pedernales	35	45	20	4
37---------- Purves	---	30	15	---
38**---------- Purves	---	---	---	---
39---------- Renick	---	---	---	---
40**: Spicewood----------	---	---	---	3.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Grain sorghum	Oats	Wheat	Pasture
	Bu	Bu	Bu	AUM*
40**: Rock outcrop.				
41---------- Tarpley	25	30	---	---
42**---------- Tarpley	---	---	---	---
43---------- Throck variant	---	45	---	---
44**---------- Voca	---	---	---	3.0
45---------- Weswood	80	80	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	16,612	---	---	---	---
II	106,458	100,730	1,392	2,118	2,218
III	129,765	129,765	---	---	---
IV	54,205	20,399	---	33,806	---
V	---	---	---	---	---
VI	453,922	---	---	453,922	---
VII	336,318	---	---	336,318	---
VIII	---	---	---	---	---

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1* Aledo	Shallow	Favorable Normal Unfavorable	3,000 2,000 1,800	Little bluestem Indiangrass Sideoats grama Big bluestem Switchgrass Silver bluestem Hairy grama Hairy dropseed Texas wintergrass	30 15 10 10 5 5 5 5 5
2, 3 Anhalt	Deep Redland	Favorable Normal Unfavorable	6,000 5,000 3,000	Little bluestem Indiangrass Big bluestem Texas wintergrass Sideoats grama Silver bluestem Vine-mesquite Plains lovegrass Curlymesquite	30 15 10 10 5 5 5 5 5
4, 5 Bolar	Clay Loam	Favorable Normal Unfavorable	6,000 5,000 3,000	Little bluestem Indiangrass Big bluestem Sideoats grama Silver bluestem Tall dropseed Texas wintergrass Canada wildrye	20 15 10 10 5 5 5 5
6* Brackett	Adobe	Favorable Normal Unfavorable	4,000 3,200 1,800	Little bluestem Sideoats grama Tall grama Indiangrass Silver bluestem	40 8 7 5 5
7*:					
Brackett	Steep Adobe	Favorable Normal Unfavorable	3,000 2,200 1,500	Little bluestem Sideoats grama Tall grama Indiangrass Tall dropseed Silver bluestem Slim tridens Hairy grama	30 10 10 10 5 5 5 5
Real	Steep Adobe	Favorable Normal Unfavorable	3,500 2,500 1,500	Little bluestem Big bluestem Indiangrass	40 10 10
8 Click	Granite Gravel	Favorable Normal Unfavorable	2,000 1,750 1,200	Little bluestem Arizona cottontop Sideoats grama Indiangrass Purpletop Fringeleaf paspalum Pinhole bluestem Vine-mesquite Post oak Blackjack oak Live oak	30 10 10 5 5 5 5 5 5 5 5

See footnote at end of table.

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

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
9---------- Doss	Shallow----------	Favorable	3,000	Sideoats grama----------	30
		Normal	2,500	Little bluestem----------	25
		Unfavorable	1,800	Pinhole bluestem----------	5
				Plains lovegrass----------	5
				Vine-mesquite----------	5
				Texas wintergrass----------	5
				Buffalograss----------	5
				Fall witchgrass----------	5
10*:					
Eckert----------	Stony Loam----------	Favorable	1,200	Little bluestem----------	25
		Normal	900	Green sprangletop----------	15
		Unfavorable	500	Sideoats grama----------	10
				Arizona cottontop----------	5
				Fall witchgrass----------	5
				Hooded windmillgrass----------	5
				Pinhole bluestem----------	5
				Vine-mesquite----------	5
Rock outcrop.					
11*---------- Eckrant	Low Stony Hills----------	Favorable	3,000	Little bluestem----------	20
		Normal	2,500	Sideoats grama----------	20
		Unfavorable	1,500	Indiangrass----------	10
				Pinhole bluestem----------	5
				Green sprangletop----------	5
				Fall witchgrass----------	5
				Meadow dropseed----------	5
12*:					
Eckrant----------	Steep Rocky----------	Favorable	3,000	Little bluestem----------	20
		Normal	2,500	Sideoats grama----------	20
		Unfavorable	1,500	Indiangrass----------	10
				Pinhole bluestem----------	5
				Green sprangletop----------	5
				Fall witchgrass----------	5
				Meadow dropseed----------	5
Rock outcrop.					
13*:					
Harper----------	Stony Upland----------	Favorable	5,000	Little bluestem----------	25
		Normal	4,200	Sideoats grama----------	20
		Unfavorable	3,000	Indiangrass----------	5
				Silver bluestem----------	5
				Cane bluestem----------	5
				Plains lovegrass----------	5
				Tall dropseed----------	5
				Texas wintergrass----------	5
				Hairy grama----------	5
Rock outcrop.					
14---------- Heaton	Sandy----------	Favorable	4,500	Little bluestem----------	25
		Normal	3,500	Big bluestem----------	10
		Unfavorable	2,000	Indiangrass----------	10
				Post oak----------	8
				Blackjack oak----------	7
				Sand lovegrass----------	5
				Purpletop----------	5
				Tall dropseed----------	5
				Silver bluestem----------	5
				Scribner panicum----------	5

See footnote at end of table.

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

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
15, 16, 17*--------- Hensley	Redland---------- ----------	Favorable Normal Unfavorable	5,000 4,000 2,500	Little bluestem---------- Indiangrass---------- Sideoats grama---------- Big bluestem---------- Silver bluestem---------- Switchgrass---------- Blue grama----------	30 20 10 5 5 5 5
18, 19---------- Houston Black	Blackland---------- ----------	Favorable Normal Unfavorable	7,000 6,000 3,500	Little bluestem---------- Indiangrass---------- Switchgrass---------- Sideoats grama---------- Vine-mesquite----------	50 25 5 5 5
20---------- Hye	Red Sandy Loam---------- ----------	Favorable Normal Unfavorable	4,500 4,000 1,800	Little bluestem---------- Sandhill lovegrass---------- Sideoats grama---------- Indiangrass---------- Purpletop---------- Arizona cottontop---------- Pinhole bluestem---------- Plains bristlegrass---------- Live oak---------- Post oak----------	30 10 10 5 5 5 5 5 5 5
21---------- Karnes	Clay Loam---------- ----------	Favorable Normal Unfavorable	4,000 3,000 1,500	Little bluestem---------- Indiangrass---------- Sideoats grama---------- Meadow dropseed---------- Vine-mesquite---------- Canada wildrye---------- Texas wintergrass----------	35 20 10 10 5 5 5
22---------- Katemcy	Schist---------- ----------	Favorable Normal Unfavorable	3,500 2,800 1,500	Sideoats grama---------- Vine-mesquite---------- Arizona cottontop---------- Pinhole bluestem---------- Plains bristlegrass---------- Buffalograss---------- Texas wintergrass---------- Curlymesquite----------	20 15 10 10 5 5 5 5
23*: Keese---------- ----------	Shallow Gneiss---------- ----------	Favorable Normal Unfavorable	1,500 1,300 1,000	Little bluestem---------- Indiangrass---------- Sideoats grama---------- Sand lovegrass---------- Plains lovegrass---------- Canada wildrye---------- Green sprangletop---------- Hairy grama----------	25 10 10 5 5 5 5 5
Rock outcrop.					
24, 25---------- Krum	Clay Loam---------- ----------	Favorable Normal Unfavorable	6,500 6,000 4,000	Little bluestem---------- Big bluestem---------- Indiangrass----------	50 15 10
26, 27---------- Lewisville	Clay Loam---------- ----------	Favorable Normal Unfavorable	6,500 5,500 3,500	Little bluestem---------- Indiangrass---------- Big bluestem---------- Switchgrass---------- Texas wintergrass---------- Virginia wildrye---------- Torrey silver bluestem--------- Meadow dropseed---------- Buffalograss---------- Sideoats grama----------	20 15 15 10 5 5 5 5 5 5

See footnote at end of table.

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

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
28*:					
Ligon	Schist	Favorable	3,400	Sideoats grama	20
		Normal	2,700	Vine-mesquite	15
		Unfavorable	1,000	Arizona cottontop	10
				Pinhole bluestem	10
				Plains bristlegrass	5
				Buffalograss	5
				Texas wintergrass	5
Rock outcrop.					
29	Clay Loam	Favorable	5,000	Little bluestem	30
Luckenbach		Normal	4,000	Sideoats grama	15
		Unfavorable	3,000	Indiangrass	10
				Vine-mesquite	10
				Big bluestem	5
				Canada wildrye	5
				Texas wintergrass	5
				Silver bluestem	5
				Live oak	5
30*:					
Nebgen	Sandstone Hills	Favorable	3,500	Little bluestem	40
		Normal	3,000	Sideoats grama	10
		Unfavorable	1,700	Indiangrass	5
				Pinhole bluestem	5
				Purpletop	5
				Sand lovegrass	5
				Plains lovegrass	5
				Fringeleaf paspalum	5
Oben	Red Sandy Loam	Favorable	4,500	Little bluestem	30
		Normal	3,800	Sandhill lovegrass	10
		Unfavorable	1,800	Sideoats grama	10
				Indiangrass	5
				Green sprangletop	5
				Arizona cottontop	5
				Pinhole bluestem	5
				Plains lovegrass	5
Rock outcrop.					
31, 32	Loamy Bottomland	Favorable	5,500	Indiangrass	15
Oakalla		Normal	4,500	Little bluestem	15
		Unfavorable	2,500	Big bluestem	10
				Switchgrass	10
				Southwestern bristlegrass	5
				Sideoats grama	5
				Canada wildrye	5
				Vine-mesquite	5
				Texas wintergrass	5
				Tall dropseed	5
33	Red Sandy Loam	Favorable	4,500	Little bluestem	30
Oben		Normal	3,800	Sandhill lovegrass	10
		Unfavorable	1,800	Sideoats grama	10
				Indiangrass	5
				Green sprangletop	5
				Arizona cottontop	5
				Pinhole bluestem	5
				Plains lovegrass	5

See footnote at end of table.

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

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
34*---- Owens	Shallow Clay----	Favorable	2,500	Sideoats grama----	30
		Normal	2,000	Silver bluestem----	15
		Unfavorable	1,000	Buffalograss----	10
				Vine-mesquite----	10
				Texas wintergrass----	5
				Arizona cottontop----	5
				Hairy grama----	5
				Rough tridens----	5
35, 36---- Pedernales	Tight Sandy Loam----	Favorable	3,500	Sideoats grama----	25
		Normal	3,000	Little bluestem----	15
		Unfavorable	1,500	Pinhole bluestem----	10
				Vine-mesquite----	10
				Arizona cottontop----	5
				Canada wildrye----	5
				Texas wintergrass----	5
37, 38*---- Purves	Shallow----	Favorable	3,000	Little bluestem----	30
		Normal	2,500	Indiangrass----	15
		Unfavorable	1,800	Big bluestem----	10
				Sideoats grama----	10
				Switchgrass----	5
				Hairy grama----	5
				Texas wintergrass----	5
				Silver bluestem----	5
39---- Renick	Serpentine Hills----	Favorable	2,500	Little bluestem----	25
		Normal	1,500	Sideoats grama----	15
		Unfavorable	700	Cane bluestem----	10
				Fall witchgrass----	10
				Texas wintergrass----	10
				Indiangrass----	5
				Plains lovegrass----	5
				Curlymesquite----	5
				Hairy grama----	5
40*:					
Spicewood----	Redland----	Favorable	3,000	Texas wintergrass----	30
		Normal	2,500	Little bluestem----	20
		Unfavorable	1,500	Buffalograss----	20
				Curlymesquite----	10
Rock outcrop.					
41, 42*---- Tarpley	Redland----	Favorable	5,500	Little bluestem----	25
		Normal	4,500	Indiangrass----	15
		Unfavorable	3,500	Big bluestem----	10
				Texas wintergrass----	10
				Sideoats grama----	5
				Tall dropseed----	5
				Silver bluestem----	5
				White shin oak----	5
				Live oak----	5
				Post oak----	5
43---- Throck variant	Shallow Clay----	Favorable	3,500	Sideoats grama----	20
		Normal	2,500	Buffalograss----	20
		Unfavorable	1,200	Vine-mesquite----	10
				Texas wintergrass----	10
				Arizona cottontop----	10
				Silver bluestem----	5

See footnote at end of table.

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

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
44* Voca	Granite Gravel	Favorable Normal Unfavorable	2,000 1,800 1,200	Little bluestem Arizona cottontop Sideoats grama Indiangrass Sandhill lovegrass Pinhole bluestem Vine-mesquite Scribner panicum Texas wintergrass	30 10 10 5 5 5 5 5 5
45 Weswood	Loamy Bottomland	Favorable Normal Unfavorable	6,000 5,000 4,000	Indiangrass Switchgrass Big bluestem Little bluestem Canada wildrye Texas wintergrass Sideoats grama Vine-mesquite	20 15 10 10 5 5 5 5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1* Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
2, 3 Anhalt	Severe: depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: depth to rock, shrink-swell, low strength.	Severe: depth to rock, shrink-swell, low strength.	Severe: shrink-swell, low strength.
4 Bolar	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength, depth to rock.	Moderate: low strength.	Severe: low strength.
5 Bolar	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength, depth to rock.	Moderate: low strength, slope.	Severe: low strength.
6* Brackett	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
7*: Brackett	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: depth to rock.
Real	Severe: small stones.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
8 Click	Moderate: depth to rock, small stones.	Slight	Moderate: depth to rock.	Slight	Slight.
9 Doss	Severe: depth to rock, too clayey.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.
10*: Eckert	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop.					
11* Eckrant	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
12*: Eckrant	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Rock outcrop.					
13*: Harper	Severe: depth to rock, too clayey, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones, shrink-swell.
Rock outcrop.					
14 Heaton	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.

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
15, 16, 17*---- Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
18, 19---- Houston Black	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
20---- Hye	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
21---- Karnes	Slight----	Slight----	Slight----	Slight----	Moderate: low strength.
22---- Katemcy	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, low strength.
23*: Keese----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Rock outcrop.					
24, 25---- Krum	Severe: cutbanks cave, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
26, 27---- Lewisville	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
28*: Ligon----	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.
Rock outcrop.					
29---- Luckenbach	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
30*: Nebgen----	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Oben----	Moderate: depth to rock, large stones.	Moderate: depth to rock, large stones.	Moderate: depth to rock, large stones.	Moderate: depth to rock.	Moderate: depth to rock, large stones.
Rock outcrop.					
31, 32---- Oakalla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
33---- Oben	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
34*---- Owens	Severe: too clayey, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.
35, 36---- Pedernales	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.

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
37---------- Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
38*---------- Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
39---------- Renick	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
40*: Spicewood-------- Rock outcrop.	Severe: depth to rock, small stones.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, small stones, low strength.
41, 42*---------- Tarpley	Severe: depth to rock.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.
43---------- Throck variant	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
44*---------- Voca	Severe: small stones, too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
45---------- Weswood	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1* Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
2, 3 Anhalt	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
4, 5 Bolar	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
6* Brackett	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
7*: Brackett	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Real	Severe: depth to rock.	Severe: depth to rock, small stones, slope.	Moderate: depth to rock.	Moderate: slope.	Poor: small stones.
8 Click	Severe: seepage.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
9 Doss	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: thin layer, area reclaim.
10*: Eckert	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock, large stones.
Rock outcrop.					
11* Eckrant	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Slight	Poor: too clayey, large stones.
12*: Eckrant	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Moderate: slope.	Poor: too clayey, large stones.
Rock outcrop.					
13*: Harper	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock.	Slight	Poor: too clayey, large stones.
Rock outcrop.					
14 Heaton	Slight	Moderate: seepage.	Slight	Slight	Fair: too sandy.
15, 16, 17* Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	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
18--Houston Black	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
19--Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
20--Hye	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Good.
21--Karnes	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: excess lime.
22--Katemcy	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Moderate: depth to rock, too clayey.	Slight	Fair: thin layer.
23*:					
Keese	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer.
Rock outcrop.					
24, 25--Krum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
26, 27--Lewisville	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
28*:					
Ligon	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Rock outcrop.					
29--Luckenbach	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
30*:					
Nebgen	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
Oben	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Rock outcrop.					
31--Oakalla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
32--Oakalla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
33--Oben	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
34*--Owens	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, area reclaim.
35, 36--Pedernales	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
37--Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.

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
38* Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
39 Renick	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
40*: Spicewood	Severe: percs slowly, depth to rock.	Severe: depth to rock, small stones.	Severe: depth to rock.	Slight	Fair: too clayey, small stones.
Rock outcrop.					
41, 42* Tarpley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
43 Throck variant	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
44* Voca	Severe: percs slowly, depth to rock.	Moderate: depth to rock, slope.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey, small stones.
45 Weswood	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

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

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1* Aledo	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
2, 3 Anhalt	Poor: depth to rock, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
4, 5 Bolar	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
6* Brackett	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
7*: Brackett	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Real	Good	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
8 Click	Good	Poor: excess fines.	Poor: excess fines.	Poor: small stones.
9 Doss	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
10*: Eckert	Poor: large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Rock outcrop.				
11* Eckrant	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
12*: Eckrant	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
Rock outcrop.				
13*: Harper	Poor: large stones, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
Rock outcrop.				
14 Heaton	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
15, 16 Hensley	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
17* Hensley	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18, 19---------- Houston Black	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
20---------- Hye	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
21---------- Karnes	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
22---------- Katemcy	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
23*: Keese----------	Poor: thin layer.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: small stones.
Rock outcrop.				
24, 25---------- Krum	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
26, 27---------- Lewisville	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
28*: Ligon----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Rock outcrop.				
29---------- Luckenbach	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
30*: Nebgen----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Oben----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: large stones.
Rock outcrop.				
31, 32---------- Oakalla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
33---------- Oben	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
34*---------- Owens	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
35, 36---------- Pedernales	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
37, 38*---------- Purves	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
39--- Renick	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
40*: Spicewood---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Rock outcrop.				
41--- Tarpley	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
42*--- Tarpley	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, thin layer.
43--- Throck variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
44*--- Voca	Fair: shrink-swell, low strength, area reclaim.	Unsuited: excess fines, small stones.	Unsuited: excess fines.	Poor: small stones.
45--- Weswood	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WATER MANAGEMENT

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

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1* Aledo	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
2, 3 Anhalt	Severe: depth to rock.	Moderate: depth to rock, compressible.	Percs slowly, depth to rock.	Percs slowly, droughty.	Percs slowly, depth to rock.	Percs slowly, droughty.
4, 5 Bolar	Severe: seepage.	Moderate: thin layer.	Depth to rock	Excess lime	Favorable	Favorable.
6* Brackett	Severe: seepage.	Severe: thin layer.	Depth to rock	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
7*: Brackett	Severe: seepage.	Severe: thin layer.	Depth to rock	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Real	Severe: depth to rock, seepage.	Severe: thin layer, seepage.	Not needed	Droughty, excess lime, seepage.	Not needed	Not needed.
8 Click	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Droughty, fast intake.	Not needed	Droughty.
9 Doss	Severe: depth to rock, seepage.	Moderate: low strength.	Depth to rock	Droughty, excess lime.	Depth to rock	Droughty, rooting depth.
10*: Eckert	Severe: depth to rock.	Severe: depth to rock, large stones.	Depth to rock	Droughty, rooting depth.	Depth to rock, large stones.	Not needed.
Rock outcrop.						
11* Eckrant	Severe: depth to rock.	Severe: thin layer, large stones.	Not needed	Rooting depth, droughty.	Depth to rock, large stones.	Rooting depth.
12*: Eckrant	Severe: depth to rock.	Severe: thin layer, large stones.	Not needed	Rooting depth, droughty.	Depth to rock, large stones.	Rooting depth.
Rock outcrop.						
13*: Harper	Severe: depth to rock.	Severe: thin layer, large stones.	Not needed	Rooting depth	Large stones, rooting depth.	Large stones, rooting depth.
Rock outcrop.						
14 Heaton	Moderate: seepage.	Moderate: erodes easily.	Not needed	Fast intake, soil blowing.	Piping, erodes easily.	Droughty, erodes easily.
15, 16, 17* Hensley	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, slow intake.	Depth to rock	Percs slowly, rooting depth.
18, 19 Houston Black	Slight	Moderate: compressible, unstable fill.	Percs slowly	Slow intake	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
20---------- Hye	Severe: depth to rock.	Moderate: depth to rock.	Not needed-----	Slope, rooting depth.	Complex slope, depth to rock.	Depth to rock.
21---------- Karnes	Severe: seepage.	Slight---------	Not needed-----	Fast intake, excess lime.	Favorable------	Favorable.
22---------- Katemcy	Severe: depth to rock.	Moderate: thin layer, compressible.	Depth to rock, percs slowly.	Slow intake, slope.	Depth to rock, percs slowly.	Percs slowly.
23*: Keese----------	Severe: depth to rock, seepage.	Severe: depth to rock.	Depth to rock	Droughty, slope.	Depth to rock, slope.	Droughty, slope.
Rock outcrop.						
24, 25---------- Krum	Moderate: seepage.	Moderate: hard to pack.	Not needed-----	Slow intake----	Percs slowly, erodes easily.	Percs slowly, erodes easily.
26, 27---------- Lewisville	Moderate: seepage.	Moderate: unstable fill.	Favorable------	Favorable------	Favorable------	Favorable.
28*: Ligon----------	Severe: depth to rock, seepage.	Severe: thin layer.	Depth to rock	Droughty, rooting depth.	Depth to rock	Droughty, rooting depth.
Rock outcrop.						
29---------- Luckenbach	Moderate: seepage.	Moderate: compressible.	Not needed-----	Favorable------	Favorable------	Favorable.
30*: Nebgen----------	Severe: depth to rock.	Moderate: unstable fill, piping.	Not needed-----	Droughty, rooting depth.	Rooting depth, depth to rock, large stones.	Droughty, rooting depth, slope.
Oben----------	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock	Rooting depth, droughty.
Rock outcrop.						
31, 32---------- Oakalla	Moderate: seepage.	Moderate: compressible.	Not needed-----	Floods---------	Floods---------	Favorable.
33---------- Oben	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock	Rooting depth, droughty.
34*---------- Owens	Slight---------	Moderate: compressible.	Not needed-----	Droughty, percs slowly.	Slope, rooting depth.	Droughty, erodes easily.
35, 36---------- Pedernales	Moderate: seepage.	Moderate: compressible.	Percs slowly---	Percs slowly---	Favorable------	Favorable.
37, 38*---------- Purves	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
39---------- Renick	Severe: depth to rock.	Severe: depth to rock.	Not needed-----	Droughty-------	Depth to rock	Droughty.
40*: Spicewood--------	Severe: depth to rock.	Moderate: depth to rock.	Not needed-----	Slow intake, droughty.	Depth to rock	Depth to rock.
Rock outcrop.						
41---------- Tarpley	Severe: depth to rock.	Severe: thin layer.	Not needed-----	Rooting depth, percs slowly.	Depth to rock	Rooting depth.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
42*---------- Tarpley	Severe: depth to rock.	Severe: thin layer.	Not needed-----	Rooting depth, percs slowly.	Depth to rock, large stones.	Rooting depth, large stones.
43---------- Throck variant	Moderate: seepage.	Moderate: compressible.	Not needed-----	Complex slope, droughty.	Favorable------	Favorable.
44*---------- Voca	Moderate: depth to rock, seepage.	Moderate: thin layer.	Not needed-----	Slow intake, percs slowly, slope.	Percs slowly---	Droughty, percs slowly.
45---------- Weswood	Moderate: seepage.	Moderate: piping, erodes easily.	Not needed-----	Favorable------	Favorable------	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1* Aledo	Moderate: too clayey.	Moderate: too clayey.	Severe: depth to rock, small stones.	Moderate: too clayey.
2, 3 Anhalt	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
4, 5 Bolar	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
6* Brackett	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
7*: Brackett	Moderate: percs slowly, slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Real	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope.	Moderate: small stones.
8 Click	Slight	Slight	Moderate: small stones.	Slight.
9 Doss	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
10*: Eckert	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Severe: large stones.
Rock outcrop.				
11* Eckrant	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones, too clayey.	Severe: large stones, too clayey.
12*: Eckrant	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, slope, large stones.	Severe: large stones, too clayey.
Rock outcrop.				
13*: Harper	Severe: too clayey, large stones.	Severe: too clayey, large stones.	Severe: depth to rock, large stones, too clayey.	Severe: too clayey, large stones.
Rock outcrop.				
14 Heaton	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing, too sandy.	Moderate: too sandy.
15, 16 Hensley	Moderate: percs slowly.	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
17* Hensley	Moderate: large stones.	Slight	Severe: depth to rock.	Moderate: large stones.
18, 19 Houston Black	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
20 Hye	Slight	Slight	Moderate: slope.	Slight.
21 Karnes	Slight	Slight	Moderate: slope.	Slight.
22 Katemcy	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
23*: Keese	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock, small stones.	Slight.
Rock outcrop.				
24, 25 Krum	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
26, 27 Lewisville	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
28*: Ligon	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Rock outcrop.				
29 Luckenbach	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey, slope.	Moderate: too clayey.
30*: Nebgen	Severe: thin layer.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
Oben	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Slight.
Rock outcrop.				
31 Oakalla	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
32 Oakalla	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: too clayey, floods.
33 Oben	Slight	Slight	Severe: depth to rock.	Slight.
34* Owens	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey.
35, 36 Pedernales	Moderate: percs slowly.	Slight	Moderate: percs slowly.	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
37--- Purves	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
38*--- Purves	Severe: too clayey.	Severe: too clayey.	Severe: large stones.	Severe: too clayey.
39--- Renick	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: large stones, too clayey.
40*: Spicewood---	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly, small stones.	Moderate: too clayey.
Rock outcrop.				
41, 42*--- Tarpley	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock.	Severe: too clayey.
43--- Throck variant	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
44*--- Voca	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
45--- Weswood	Slight---	Slight---	Slight---	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that 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	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1*----- Aledo	Poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor
2, 3----- Anhalt	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
4----- Bolar	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
5----- Bolar	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
6*----- Brackett	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
7*:									
Brackett----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Fair
Real----------	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor
8----- Click	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair
9----- Doss	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
10*:									
Eckert----------	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor
Rock outcrop.									
11*----- Eckrant	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
12*:									
Eckrant----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Rock outcrop.									
13*:									
Harper----------	Poor	Poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor
Rock outcrop.									
14----- Heaton	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
15, 16, 17*----- Hensley	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
18, 19----- Houston Black	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair
20----- Hye	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
21----- Karnes	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair
22----- Katemcy	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	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 herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
23*: Keese	Very poor	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Poor
Rock outcrop.									
24 Krum	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
25 Krum	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
26, 27 Lewisville	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
28*: Ligon	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair
Rock outcrop.									
29 Luckenbach	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair
30*: Nebgen	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
Oben	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair
Rock outcrop.									
31, 32 Oakalla	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
33 Oben	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
34*: Owens	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
35 Pedernales	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
36 Pedernales	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
37 Purves	Fair	Good	Poor	Good	Poor	Very poor	Fair	Very poor	Fair
38* Purves	Poor	Poor	Poor	Good	Poor	Very poor	Poor	Very poor	Fair
39 Renick	Very poor	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Poor
40*: Spicewood	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair
Rock outcrop.									
41 Tarpley	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
42* Tarpley	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	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	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
43---------- Throck variant	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
44*---------- Voca	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair
45---------- Weswood	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1* Aledo	0-4	Gravelly clay loam.	CL, GC, GM, SC	A-4, A-6	0-20	65-95	60-90	55-90	40-70	30-40	10-20
	4-13	Very gravelly clay loam.	GC, GM, SC	A-2-4, A-2-6	5-30	35-55	30-50	25-50	15-35	30-40	10-20
	13-16	Weathered bedrock.	---	---	---	---	---	---	---	---	---
2, 3 Anhalt	0-29	Clay	CH	A-7-6	0-10	85-100	85-100	85-100	80-100	51-88	32-62
	29-44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
4, 5 Bolar	0-13	Clay loam	CL, SC	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-42	9-25
	13-38	Clay loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	38-39	Weathered bedrock.	---	---	---	---	---	---	---	---	---
6* Brackett	0-14	Clay loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	14-30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
7*:											
Brackett	0-19	Clay loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	19-30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Real	0-15	Gravelly clay loam, very gravelly clay loam.	GC, SC, GP-GM, SP-SM	A-2-6, A-2-4	1-10	25-75	10-50	10-45	10-35	25-35	8-15
	15-60	Variable, weathered bedrock.	---	---	---	---	---	---	---	---	---
8 Click	0-14	Gravelly sandy loam.	SM, SM-SC	A-1, A-2	0-5	75-95	45-65	20-50	15-35	<23	NP-7
	14-54	Gravelly sandy loam, very gravelly sandy loam.	SC, GC, SM-SC, GM-GC	A-1, A-2	0-5	50-90	27-50	20-50	15-35	18-28	4-10
9 Doss	0-17	Silty clay	CL, CH	A-7-6	0-20	90-100	85-100	80-100	80-95	41-55	20-33
	17-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
10*:											
Eckert	0-7	Stony loam	ML, CL-ML	A-4	25-70	75-95	75-95	75-95	60-80	<30	NP-7
	7-8	Indurated, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
11* Eckrant	0-11	Very cobbly clay	GC, SC	A-7-6, A-2-7	25-75	45-80	40-75	35-55	30-50	54-74	31-49
	11-12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12*:											
Eckrant	0-11	Very cobbly clay	GC, SC	A-7-6, A-2-7	25-75	45-80	40-75	35-55	30-50	54-74	31-49
	11-12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote 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	
12*:											
Rock outcrop.											
13*:											
Harper	0-18	Clay	CH	A-7-6	0-10	90-100	85-100	85-100	75-95	55-75	33-49
	18-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
14	0-22	Loamy fine sand	SM	A-2-4	0	95-100	95-100	70-90	15-30	<25	NP-3
Heaton	22-80	Sandy clay loam	SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0	98-100	95-100	75-90	25-45	20-35	4-15
15, 16	0-5	Loam	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-85	20-40	5-20
Hensley	5-18	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	18-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
17*	0-5	Stony loam	CL, SC, GC, GM-GC	A-6, A-4	8-25	65-95	60-95	55-95	36-80	20-40	5-20
Hensley	5-18	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	18-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
18, 19	0-80	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
Houston Black											
20	0-18	Fine sandy loam	SM-SC, SC	A-2, A-4	0-5	75-100	70-100	70-95	25-50	20-30	4-10
Hye	18-36	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6, A-2-4, A-2-6	0-5	75-100	70-100	70-98	33-55	27-40	8-21
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
21	0-49	Loam	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	50-100	30-65	20-35	4-15
Karnes	49-72	Loam, fine sandy loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	85-100	75-100	45-100	25-65	20-35	4-15
22	0-9	Loam	CL, CL-ML	A-4, A-6	0-2	85-100	75-99	70-91	51-75	20-35	4-15
Katemcy	9-28	Clay, clay loam	CL, CH, SC	A-7-6	0-2	85-100	74-97	53-92	39-85	41-56	20-30
	28-35	Gravelly clay loam, gravelly clay.	SC	A-7-6	0-25	75-95	65-80	45-65	35-50	36-50	15-28
	35-44	Weathered bedrock.	---	---	---	---	---	---	---	---	---
23*:											
Keese	0-17	Gravelly sandy loam.	SW-SM, SM, SM-SC, SP-SM	A-1, A-2-4	0-5	70-90	55-85	30-45	10-20	<25	NP-7
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
24, 25	0-13	Clay	CH	A-7-6	0	95-100	85-100	85-100	85-95	51-65	25-42
Krum	13-39	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	39-72	Silty clay loam, silty clay, clay.	CH, CL	A-7-6	0	85-100	75-100	70-95	65-95	48-60	28-38
26, 27	0-18	Clay loam	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
Lewisville	18-58	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	58-63	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
28*:											
Ligon	0-4	Clay loam	CL, SC	A-6	0-3	80-100	65-100	60-80	45-80	35-40	15-20
	4-15	Clay loam	CL, SC	A-6, A-7-6	0-3	80-95	65-95	60-85	48-85	38-44	16-22
	15-22	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
29	0-17	Clay loam	CL	A-6	0-3	95-100	95-100	75-95	55-65	29-40	14-25
Luckenbach	17-36	Clay loam, clay	CL, CH	A-6, A-7	0-3	90-100	80-100	80-100	60-85	40-55	22-35
	36-80	Clay loam, clay	CL, SC	A-6, A-7	0-5	70-100	60-95	45-95	36-80	35-45	20-30
30*:											
Nebgen	0-14	Fine sandy loam	SC, CL, SM, ML	A-4, A-6	2-25	75-100	75-100	70-85	40-55	20-32	4-13
	14-23	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Oben	0-7	Stony sandy loam	SC, CL, SM-SC, CL-ML	A-4	5-20	90-100	90-100	70-85	40-55	<25	NP-10
	7-15	Stony sandy loam, fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0-20	90-100	90-100	80-95	45-75	26-36	8-15
	15-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
31	0-60	Loam	CL	A-6, A-7-6	0-2	85-100	80-100	70-100	65-95	35-4=	1>=25
Oakalla											
32	0-60	Silty clay loam	CL	A-6, A-7-6	0-2	85-100	80-100	70-100	65-95	35-45	16-25
Oakalla											
33	0-6	Fine sandy loam	SC, CL, SM-SC, CL-ML	A-4	0-5	90-100	90-100	70-85	40-55	<25	NP-10
Oben	6-19	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0-5	90-100	90-100	80-95	45-75	26-36	8-15
	19-26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
34*	0-4	Clay	CL, CH	A-7-6	0-5	95-100	95-100	85-100	75-95	45-60	22-32
Owens	4-18	Clay, clay loam	CL, CH	A-7-6	0-5	95-100	90-100	85-100	75-95	45-60	22-32
	18-25	Shaly clay	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	55-95	40-55	25-35

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
35, 36---------- Pedernales	0-11	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0	95-100	90-100	75-100	25-55	<25	NP-7
	11-38	Sandy clay, clay	CH, CL, SC	A-7, A-6	0	90-100	90-100	80-100	45-75	38-60	20-36
	38-80	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-6, A-7	0-5	90-100	90-100	80-100	36-75	32-55	13-30
37---------- Purves	0-9	Gravelly clay---	CH, GC, SC	A-7-6	5-25	55-95	55-95	45-95	36-90	51-65	30-40
	9-16	Gravelly clay, very gravelly clay, stony clay.	GC, CH, SC	A-7-6	5-35	55-95	55-95	45-90	36-65	51-65	30-40
	16-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
38*---------- Purves	0-9	Stony clay------	CH, GC, SC	A-7-6	5-25	55-95	55-95	45-95	36-90	51-65	30-40
	9-16	Gravelly clay, very gravelly clay, stony clay.	GC, CH, SC	A-7-6	5-35	55-95	55-95	45-90	36-65	51-65	30-40
	16-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
39---------- Renick	0-18	Clay loam-------	CH	A-7-6	2-20	80-90	80-90	70-80	50-75	51-60	30-36
	18-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
40*: Spicewood---------	0-8	Cobbly clay loam	GC, SC, CL	A-2-7, A-7-6	10-30	50-90	40-70	40-65	25-65	41-50	20-28
	8-22	Very cobbly clay	GC	A-2-7, A-7-6	5-50	45-75	40-65	35-60	25-50	55-75	32-48
	22-38	Clay------------	CH	A-7-6	0-5	90-100	80-95	80-95	75-90	55-75	32-48
	38-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
	40-41	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
41---------- Tarpley	0-8	Clay------------	CL, CH	A-7	0-3	90-100	90-100	80-95	70-90	41-60	20-38
	8-15	Clay------------	CH	A-7	0	90-100	90-100	90-100	65-98	70-90	45-60
	15-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
42*---------- Tarpley	0-8	Stony clay------	CL, CH	A-7	10-30	85-100	85-98	75-95	65-90	41-60	20-38
	8-15	Clay, cobbly clay.	CH	A-7	0-15	85-100	85-100	85-100	60-95	70-90	45-60
	15-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43---------- Throck variant	0-8	Silty clay loam	CL	A-6, A-7-6	0-2	85-100	80-99	75-99	60-90	30-45	14-28
	8-41	Silty clay loam	CL	A-6, A-7-6	0-2	80-100	80-100	75-99	70-95	33-48	18-30
	41-80	Sandy clay loam, silty clay loam, shaly clay.	CL	A-6, A-7-6	0	90-100	90-100	85-100	70-95	30-50	14-30

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
				O		4	10	40	200		
	In				Pct					Pct	
44*---------- Voca	0-8	Gravelly sandy loam.	SM, SM-SC	A-2-4, A-1-B	0-5	70-95	50-95	30-50	20-35	<25	NP-7
	8-28	Gravelly clay, gravelly sandy clay.	SC, GC	A-2-7, A-7-6	0-8	55-85	50-70	30-60	25-50	51-65	27-40
	28-48	Very gravelly clay, very gravelly sandy clay, gravelly clay.	GC, SC	A-2-7, A-7-6	0-10	25-85	20-65	15-50	13-45	45-60	25-35
	48-84	Weathered bedrock.	---	---	---	---	---	---	---	---	---
45---------- Weswood	0-63	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	20-35	4-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
1*----------	0-4	0.6-2.0	0.07-0.18	7.9-8.4	Moderate-------	0.32	1
Aledo	4-13	0.6-2.0	0.05-0.12	7.9-8.4	Low----------	0.10	
	13-16	---	---	---	----------	---	
2, 3----------	0-29	<0.06	0.15-0.18	6.1-8.4	Very high------	0.32	2
Anhalt	29-44	---	---	---	----------	---	
4, 5----------	0-13	0.6-2.0	0.11-0.20	7.9-8.4	Moderate-------	0.32	2
Bolar	13-38	0.6-2.0	0.11-0.20	7.9-8.4	Moderate-------	0.17	
	38-39	---	---	---	----------	---	
6*----------	0-14	0.2-0.6	0.10-0.20	7.9-8.4	Low----------	0.32	2
Brackett	14-30	---	---	---	----------	---	
7*:							
Brackett--------	0-19	0.2-0.6	0.10-0.20	7.9-8.4	Low----------	0.32	2
	19-30	---	---	---	----------	---	
Real----------	0-15	0.6-2.0	0.05-0.10	7.9-8.4	Low----------	0.10	1
	15-60	---	---	---	----------	---	
8----------	0-14	6.0-20	0.03-0.08	6.1-7.3	Low----------	0.15	4
Click	14-54	6.0-20	0.04-0.09	6.1-7.3	Low----------	0.10	
9----------	0-17	0.2-0.6	0.15-0.20	7.9-8.4	Moderate-------	0.24	1
Doss	17-30	---	---	---	----------	---	
10*:							
Eckert----------	0-7	0.6-2.0	0.10-0.15	6.6-8.4	Low----------	0.10	1
	7-8	---	---	---	----------	---	
Rock outcrop.							
11*----------	0-11	0.2-0.6	0.05-0.12	6.6-8.4	Moderate-------	0.10	1
Eckrant	11-12	---	---	---	----------	---	
12*:							
Eckrant---------	0-11	0.2-0.6	0.05-0.12	6.6-8.4	Moderate-------	0.10	1
	11-12	---	---	---	----------	---	
Rock outcrop.							
13*:							
Harper----------	0-18	0.2-0.6	0.15-0.20	7.4-8.4	High----------	0.32	1
	18-19	---	---	---	----------	---	
Rock outcrop.							
14----------	0-22	2.0-6.0	0.05-0.09	5.6-7.3	Very low-------	0.17	5
Heaton	22-80	0.6-2.0	0.14-0.16	5.6-7.3	Low----------	0.24	
15, 16----------	0-5	0.2-0.6	0.12-0.20	6.1-7.8	Low----------	0.32	1
Hensley	5-18	0.06-0.2	0.10-0.20	5.6-8.4	Moderate-------	0.32	
17*----------	0-5	0.2-0.6	0.10-0.18	6.1-7.8	Low----------	0.32	1
Hensley	5-18	0.06-0.2	0.10-0.20	6.6-8.4	Moderate-------	0.32	
18, 19----------	0-80	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32	5
Houston Black							
20----------	0-18	2.0-6.0	0.11-0.15	6.1-7.3	Low----------	0.24	3
Hye	18-36	0.6-2.0	0.12-0.17	6.1-7.3	Low----------	0.32	
	36-40	---	---	---	----------	---	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
21----------	0-49	2.0-6.0	0.10-0.15	7.9-8.4	Low----------	0.28	5
Karnes	49-72	2.0-6.0	0.08-0.15	7.9-8.4	Low----------	0.28	
22----------	0-9	0.6-2.0	0.15-0.20	6.1-7.8	Low----------	0.32	2
Katemcy	9-35	0.06-0.2	0.14-0.20	6.1-7.8	Moderate-------	0.32	
	35-44	---	---	---	----------	---	
23*:							
Keese----------	0-17	2.0-6.0	0.05-0.10	5.6-6.5	Low----------	0.10	1
	17-20	---	---	---	----------	---	
Rock outcrop.							
24, 25----------	0-13	0.2-0.6	0.15-0.20	7.4-8.4	High----------	0.32	5
Krum	13-39	0.2-0.6	0.14-0.20	7.9-8.4	High----------	0.32	
	39-72	0.2-0.6	0.14-0.20	7.9-8.4	High----------	0.32	
26, 27----------	0-18	0.6-2.0	0.16-0.20	7.9-8.4	High----------	0.32	4
Lewisville	18-58	0.6-2.0	0.14-0.18	7.9-8.4	High----------	0.37	
	58-63	0.6-2.0	0.14-0.18	7.9-8.4	High----------	0.37	
28*:							
Ligon----------	0-4	0.2-0.6	0.10-0.15	6.1-7.8	Moderate-------	0.32	1
	4-15	0.2-0.6	0.10-0.15	6.1-7.8	Moderate-------	0.32	
	15-22	---	---	---	----------	---	
Rock outcrop.							
29----------	0-17	0.6-2.0	0.15-0.18	6.1-7.8	Low----------	0.32	5
Luckenbach	17-36	0.2-0.6	0.13-0.18	7.4-8.4	Moderate-------	0.32	
	36-80	0.2-0.6	0.10-0.15	7.9-8.4	Moderate-------	0.28	
30*:							
Nebgen----------	0-14	2.0-6.0	0.09-0.14	6.1-7.3	Low----------	0.24	1
	14-23	---	---	---	----------	---	
Oben----------	0-7	0.6-2.0	0.08-0.14	6.1-7.3	Low----------	0.24	1
	7-15	0.6-2.0	0.08-0.16	6.1-7.3	Low----------	0.32	
	15-24	---	---	---	----------	---	
Rock outcrop.							
31, 32----------	0-60	0.6-2.0	0.12-0.19	7.9-8.4	Moderate-------	0.32	5
Oakalla							
33----------	0-6	0.6-2.0	0.10-0.16	6.1-7.3	Low----------	0.24	1
Oben	6-19	0.6-2.0	0.11-0.17	6.1-7.3	Low----------	0.32	
	19-26	---	---	---	----------	---	
34*----------	0-4	<0.06	0.13-0.17	7.9-8.4	High----------	0.32	1
Owens	4-18	<0.06	0.13-0.17	7.9-8.4	High----------	0.32	
	18-25	<0.06	0.03-0.08	7.9-8.4	High----------	0.37	
35, 36----------	0-11	0.6-2.0	0.12-0.17	6.1-7.8	Low----------	0.32	5
Pedernales	11-38	0.2-0.6	0.15-0.20	6.1-7.8	Moderate-------	0.28	
	38-80	0.2-0.6	0.15-0.20	7.9-8.4	Moderate-------	0.28	
37, 38*----------	0-9	0.2-0.6	0.08-0.15	7.9-8.4	High----------	0.24	1
Purves	9-16	0.2-0.6	0.08-0.15	7.9-8.4	High----------	0.24	
	16-18	---	---	---	----------	---	
39----------	0-18	0.2-0.6	0.15-0.20	6.1-7.8	High----------	0.15	1
Renick	18-24	---	---	---	----------	---	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
40*:							
Spicewood-------	0-8	0.2-0.6	0.08-0.15	6.1-7.3	Low----------	0.10	2
	8-22	0.06-0.2	0.05-0.10	6.1-7.3	Moderate-------	0.10	
	22-38	0.06-0.2	0.10-0.18	6.1-7.3	High----------	0.32	
	38-40	---	---	---	----------	---	
	40-41	---	---	---	----------	---	
Rock outcrop.							
41----------	0-8	0.2-0.6	0.15-0.20	6.1-7.8	High----------	0.32	1
Tarpley	8-15	0.06-0.2	0.12-0.18	6.1-7.8	Very high------	0.32	
	15-16	---	---	---	----------	---	
42*----------	0-8	0.2-0.6	0.10-0.16	6.1-7.8	High----------	0.32	1
Tarpley	8-15	0.06-0.2	0.10-0.18	6.1-7.8	Very high------	0.32	
	15-16	---	---	---	----------	---	
43----------	0-8	0.2-0.6	0.12-0.20	7.9-8.4	Moderate-------	0.32	3
Throck variant	8-41	0.06-0.2	0.12-0.20	7.9-8.4	Moderate-------	0.32	
	41-80	0.06-0.2	0.10-0.18	7.9-8.4	Moderate-------	0.32	
44*----------	0-8	2.0-6.0	0.08-0.12	6.1-7.8	Low----------	0.37	3
Voca	8-28	0.06-0.2	0.10-0.15	5.6-7.3	Moderate-------	0.28	
	28-48	0.06-0.2	0.05-0.13	5.6-7.3	Low----------	0.28	
	48-84	---	---	---	----------	---	
45----------	0-63	0.6-2.0	0.15-0.20	7.9-8.4	Low----------	0.43	5
Weswood							

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions in the Glossary explain such terms as "rare," "brief," and "very brief." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Uncoated steel	Concrete
					In			
1*----- Aledo	C	None-----	---	---	8-20	Hard	Moderate	Low.
2, 3----- Anhalt	D	None-----	---	---	20-40	Hard	High-----	Low.
4, 5----- Bolar	C	None-----	---	---	20-40	Rippable	High-----	Low.
6*----- Brackett	C	None-----	---	---	10-20	Rippable	High-----	Low.
7*:								
Brackett-----	C	None-----	---	---	10-20	Rippable	High-----	Low.
Real-----	D	None-----	---	---	8-20	Rippable	High-----	Low.
8----- Click	A	None-----	---	---	40-60	Rippable	Low------	Low.
9----- Doss	C	None-----	---	---	>60	---	High-----	Low.
10*:								
Eckert-----	D	None-----	---	---	4-14	Hard	Low------	Low.
Rock outcrop.								
11*----- Eckrant	D	None-----	---	---	8-20	Hard	High-----	Low.
12*:								
Eckrant-----	D	None-----	---	---	8-20	Hard	High-----	Low.
Rock outcrop.								
13*:								
Harper-----	D	None-----	---	---	11-20	Hard	High-----	Low.
Rock outcrop.								
14----- Heaton	A	None-----	---	---	>60	---	Moderate	Low.
15, 16, 17*----- Hensley	D	None-----	---	---	10-20	Hard	High-----	Low.
18, 19----- Houston Black	D	None-----	---	---	>60	---	High-----	Low.
20----- Hye	B	None-----	---	---	20-40	Hard	Moderate	Low.
21----- Karnes	B	None-----	---	---	>60	---	Moderate	Low.
22----- Katemcy	C	None-----	---	---	20-40	Rippable	High-----	Low.
23*:								
Keese-----	D	None-----	---	---	11-20	Hard	Low------	Low.
Rock outcrop.								

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Uncoated steel	Concrete
					In			
24, 25---------- Krum	D	None---------	---	---	>60	---	High-----	Low.
26, 27---------- Lewisville	B	None---------	---	---	>60	---	High-----	Low.
28*: Ligon---------- Rock outcrop.	D	None---------	---	---	12-20	Rippable	Moderate	Low.
29---------- Luckenbach	C	None---------	---	---	>60	---	Moderate	Low.
30*: Nebgen---------- Oben---------- Rock outcrop.	D C	None--------- None---------	--- ---	--- ---	4-14 9-20	Rippable Rippable	Low------ Low------	Low. Low.
31, 32---------- Oakalla	B	Common------	Very brief to brief.	May-Sep	>60	---	Moderate	Low.
33---------- Oben	C	None---------	---	---	9-20	Rippable	Low------	Low.
34*---------- Owens	D	None---------	---	---	10-20	Rippable	High-----	Low.
35, 36---------- Pedernales	C	None---------	---	---	>60	---	High-----	Low.
37, 38*---------- Purves	D	None---------	---	---	8-20	Hard	High-----	Low.
39---------- Renick	D	None---------	---	---	2-20	Hard	High-----	Low.
40*: Spicewood-------- Rock outcrop.	C	None---------	---	---	25-40	Hard	High-----	Low.
41, 42*---------- Tarpley	D	None---------	---	---	13-20	Hard	High-----	Low.
43---------- Throck variant	C	None---------	---	---	>60	---	High-----	Low.
44*---------- Voca	C	None---------	---	---	40-60	Rippable	High-----	Low.
45---------- Weswood	B	Rare---------	Brief-----	Mar-Sep	>60	---	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]									Liquid limit[2]	Plasticity index[2]	Moisture density		Shrinkage		
			Larger than 3 inches	Percentage passing sieve					Percentage smaller than--					Max. dry density	Optimum moisture	Limit	Linear	Ratio
	AASHTO	Unified		5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm							
			Pct										Pct		Lb/ft	Pct	Pct	Pct	Pct
Anhalt clay:[3] (S72TX-016-001)																			
Ap------ 0 to 6	A-7-6(35)	CH	0	100	100	100	100	100	97	--	55	46	54	32	--	--	11.0	18.8	2.0
A1------ 6 to 15	A-7-6(41)	CH	0	100	100	100	100	100	97	--	63	55	59	38	--	--	11.0	20.4	2.0
B2------ 15 to 29	A-7-6(39)	CH	0	100	100	100	100	99	96	--	60	53	59	36	--	--	11.0	20.3	2.0
Hye fsl:[4] (S72TX-016-003)																			
A1------ 0 to 12	A-2-4(00)	SM-SC	0	100	100	99	97	93	27	--	7	6	20	4	--	--	17.0	1.8	1.7
B1------ 12 to 18	A-2-4(00)	SM-SC	0	100	100	99	97	93	32	--	13	10	20	5	--	--	16.0	2.8	1.8
B21t---- 18 to 26	A-2-6(01)	SC	0	100	87	84	81	77	33	--	18	16	27	13	--	--	16.0	6.1	1.8
B22t---- 26 to 36	A-6 (08)	CL	0	100	100	100	99	98	54	--	35	33	38	21	--	--	17.0	10.2	1.8
Katemcy l:[5] (S72TX-016-002)																			
A1------ 0 to 9	A-4 (04)	CL	0	100	100	98	97	91	62	--	22	16	26	10	--	--	15.0	6.2	1.8
B2t----- 9 to 28	A-7-6(21)	CL	0	100	99	98	97	92	75	--	46	31	49	29	--	--	14.0	15.8	1.9
B3------ 28 to 35	A-7-6(05)	SC	15	100	94	88	74	53	39	--	19	16	44	26	--	--	14.0	13.9	1.9
Pedernales fsl:[6] (S72TX-016-005)																			
A1------ 0 to 11	A-2-4(00)	SM-SC	0	100	100	100	99	79	25	--	7	6	18	4	--	--	14.0	2.5	1.8
B21t---- 11 to 17	A-7-6(16)	CH	0	100	100	100	98	83	56	--	44	41	57	35	--	--	13.0	18.4	1.9
Cca----- 38 to 80	A-7-6(11)	CL	0	100	100	100	99	86	53	--	33	31	43	28	--	--	12.0	14.8	2.0
Throck variant sicl:[7] (S72TX-027-001)																			
Ap------ 0 to 8	A-6 (11)	CL	0	100	100	99	98	96	85	--	35	26	30	15	--	--	14.0	8.5	1.9
B22----- 17 to 32	A-6 (20)	CL	0	100	100	100	100	99	93	--	55	42	39	21	--	--	14.0	12.3	1.9
B23ca--- 32 to 41	A-6 (13)	CL	0	100	99	99	98	93	81	--	42	33	33	18	--	--	14.0	10.0	1.9

See footnotes at end of table.

TABLE 16.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density		Shrinkage		
			Larger than 3 inches	Percentage passing sieve						Percentage smaller than--					Max. dry density	Optimum moisture	Limit	Linear	Ratio
	AASHTO	Unified		5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm							
			Pct										Pct		Lb/ ft	Pct	Pct	Pct	Pct
Voca gr-sl:[8] (S72TX-016-004)																			
A1------ 0 to 8	A-1-B(00)	SM-SC	5	100	99	93	77	49	22	--	6	3	22	5	--	--	16.0	3.3	1.8
B21t---- 8 to 19	A-2-7(03)	SC	8	100	97	81	59	32	26	--	20	19	59	35	--	--	13.0	19.2	1.9
B22t---- 19 to 28	A-2-7(05)	SC	10	100	98	85	67	46	35	--	27	25	64	37	--	--	17.0	19.0	1.8
Cr&Bt--- 28 to 42	A-2-7(05)	SC	10	100	97	82	61	37	33	--	17	16	58	35	--	--	17.0	17.0	1.8

[1]For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2]Liquid limit and plastic index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3]Anhalt clay:
5 miles east of Blanco on Ranch Road 165, 1,600 feet east on improved road, 1/4 mile south and 450 feet east of road.

[4]Hye fine sandy loam:
6 miles northwest of Round Mountain on Ranch Road 962, 0.7 mile southwest on improved county road, and 150 feet southeast of road.

[5]Katemcy loam:
8 miles northwest of Round Mountain on Ranch Road 962, 4 miles west on improved county road, and 450 feet southwest of road.

[6]Pedernales fine sandy loam:
6 miles northwest of Round Mountain on Ranch Road 962, 2 miles southwest on improved county road, and 100 feet south of road.

[7]Throck variant silty clay loam:
4 miles east of Marble Falls on Ranch Road 1431, and 60 feet north into cultivated field.

[8]Voca gravelly sandy loam:
3 miles northwest of Sandy on Ranch Road 1323, 1,200 feet north on improved road, 25 feet east and 25 feet south of oak tree.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Haplustolls
Anhalt	Very-fine, montmorillonitic, thermic Udic Chromusterts
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Click	Loamy-skeletal, mixed, thermic Udic Haplustalfs
Doss	Loamy, carbonatic, thermic, shallow Typic Calciustolls
Eckert	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Eckrant	Clayey-skeletal, montmorillonitic, thermic Lithic Haplustolls
Harper	Clayey, montmorillonitic, thermic Lithic Vertic Haplustolls
Heaton	Loamy, siliceous, thermic Arenic Paleustalfs
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Hye	Fine-loamy, mixed, thermic Ultic Haplustalfs
Karnes	Coarse-loamy, carbonatic, thermic Typic Ustochrepts
Katemcy	Fine, mixed, thermic Udic Haplustalfs
Keese	Loamy, mixed, thermic Lithic Ustochrepts
Krum	Fine, montmorillonitic, thermic Vertic Haplustolls
Lewisville	Fine-silty, mixed, thermic Typic Calciustolls
Ligon	Loamy, mixed, thermic, shallow Udic Rhodustalfs
Luckenbach	Fine, mixed, thermic Typic Argiustolls
Nebgen	Loamy, mixed, nonacid, thermic, shallow Typic Ustorthents
Oakalla	Fine-loamy, carbonatic, thermic Cumulic Haplustolls
Oben	Loamy, mixed, thermic, shallow Udic Haplustalfs
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Pedernales	Fine, mixed, thermic Udic Paleustalfs
Purves	Clayey, montmorillonitic, thermic Lithic Calciustolls
Real	Loamy-skeletal, carbonatic, thermic, shallow Typic Calciustolls
Renick	Clayey, montmorillonitic, thermic Lithic Ruptic-Entic Haplustolls
Spicewood	Clayey-skeletal, montmorillonitic, thermic Pachic Argiustolls
Tarpley	Clayey, montmorillonitic, thermic Lithic Vertic Argiustolls
Throck variant	Fine, mixed, thermic Typic Ustochrepts
Voca	Fine, mixed, thermic Udic Paleustalfs
Weswood	Fine-silty, mixed, thermic Fluventic Ustochrepts

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