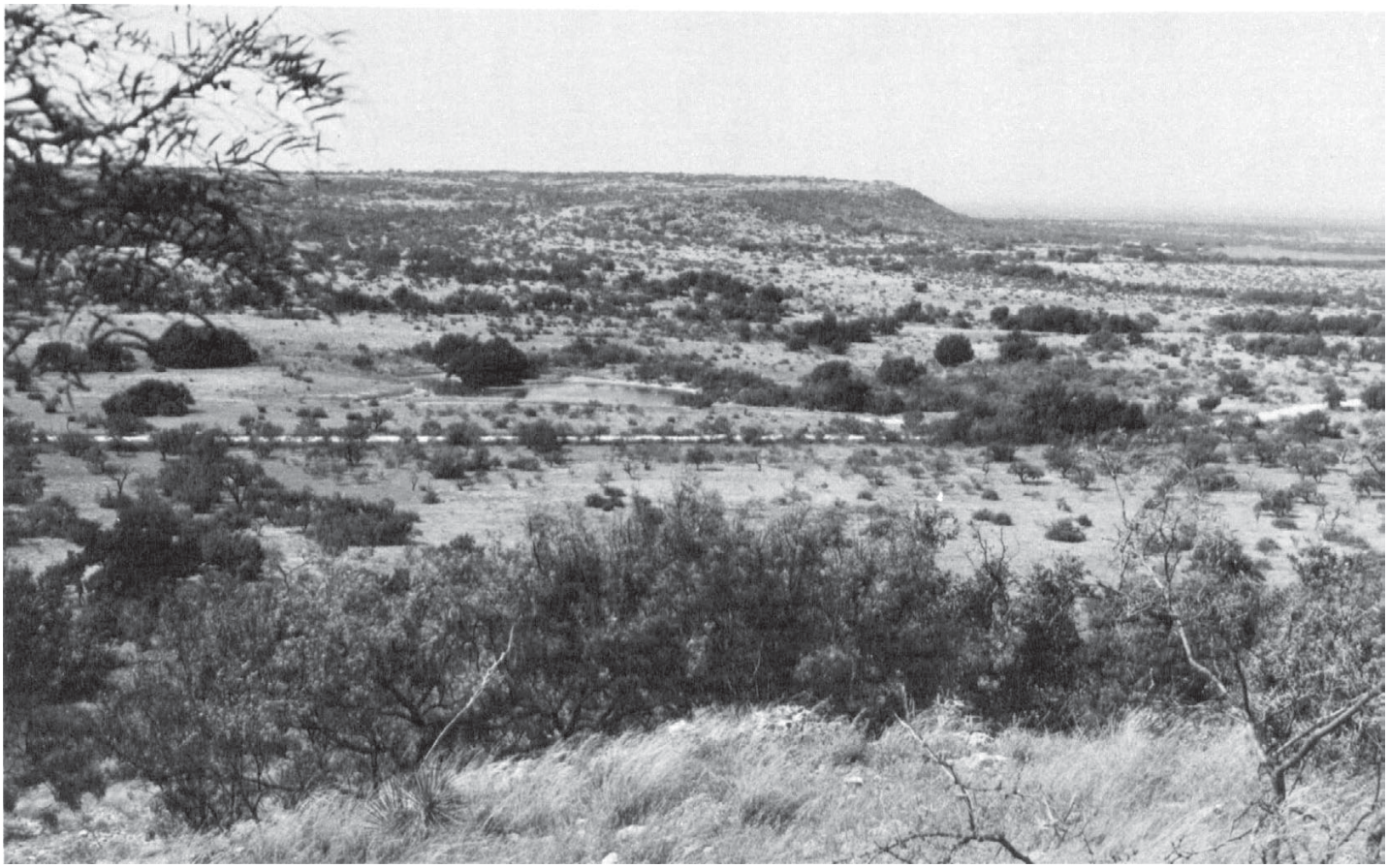
SOIL SURVEY OF

McCulloch County, Texas



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

Issued November 1974

Major fieldwork for this soil survey was done in the period 1964–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1969. 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 Concho and San Saba-Brady Soil and Water Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of McCulloch County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It shows the page where each soil is described and the page for the capability unit and the range site to which the soil has been assigned.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the range sites and capability units.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreational areas in the section "Engineering Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers to the county may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: **Typical rangeland in McCulloch County. The soils are Brackett-Tarrant association, steep, and Valera clay, 1 to 3 percent slopes. The Valera soil is in the valley.**

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Contents

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SOIL SURVEY OF McCULLOCH COUNTY, TEXAS

BY OTTO W. BYNUM AND JOHN L. COKER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

McCULLOCH COUNTY is in the geographical center of Texas (fig. 1). It has a total area of 1,066 square miles, or 682,240 acres, including 4,714 acres of water. Brady, the county seat and largest town, is on U.S. Highways No. 87 and No. 377.

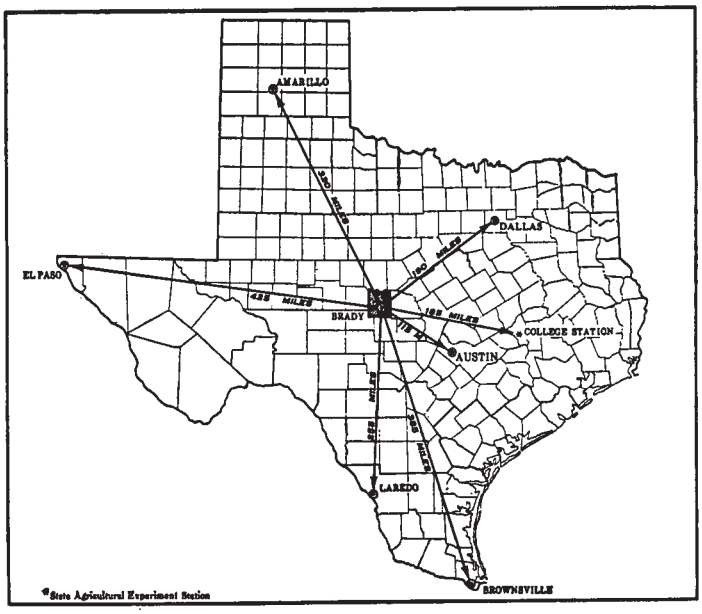

Figure 1.—**Location of McCulloch County in Texas.**

Most of McCulloch County is undulating. It is steep in areas of scarps and along rough breaks associated with major drainageways. The elevation ranges from about 2,100 feet in the southwestern part of the county to less than 1,300 feet in the valley of the Colorado River in the northeastern corner of the county.

The northern part of the county is drained by the Colorado River, and the southern part is drained by the San Saba River. Drainage is almost equally divided between the two rivers.

The northwestern part and midsection of the county are characterized by broad, nearly level to gently undulating uplands that consist of old alluvial plains and stream terraces. The overall relief in the northwestern part is broken at intervals by short, steep scarps in a scarp and cuesta landscape. In the northeastern part of the county, nearly level to gently sloping soils that formed in old alluvium extend over most of the valley floor.

The southeastern corner of the county lies within a basin, below other adjoining uplands. In this area are loamy soils in an undulating landscape that is well dissected by drainageways. The rest of the county consists of undulating uplands that are well dissected by drainageways.

Ranching and farming are the major enterprises in McCulloch County. About 25 percent of the land is used for crops, and the rest is used for range. Grain sorghum, small grain, cotton, and peanuts are the principal crops. Beef cattle, sheep, and goats are the main kinds of livestock. Most of the cropland is dryfarmed. About 2,000 acres is irrigated.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in McCulloch County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Rowena and Nuvalde, for example, are the names of two soil series.

All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

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

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of McCulloch County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Nuvalde-Mereta complex, 2 to 5 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Katemcy-Ligon association, undulating, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Acove and Cobb soils, rolling, is an example.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in McCulloch County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more soils and at least one minor soil, and is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Of the 10 soil associations in McCulloch County, seven consist of dominantly very shallow and moderately deep soils and three of dominantly deep soils. The associations are described on the following pages.

Dominantly Very Shallow and Moderately Deep Soils

The soils in these areas are mainly underlain by bedrock, such as limestone, sandstone, shale, schist, and granite. Many are stony and gravelly. The landscape is mainly undulating, but steep, receding scarps are common.

These areas are best suited to range and to use as wildlife habitat. Livestock includes cattle, sheep, and goats. Wildlife, such as deer, turkey, and quail, is abundant.

1. Tarrant-Kavett association

Very shallow to shallow, well-drained, moderately slowly permeable clayey soils over limestone

This association is an undulating landscape (fig. 2) characterized by broad ridges and shallow valleys. Slopes are dominantly 1 to 8 percent, but in small areas along scarps, they are as much as 20 percent.

This association makes up about 45 percent of the county. It is about 70 percent Tarrant soils, 10 percent Kavett soils, and 20 percent mostly Brackett, Owens, Speck, Tobosa, and Valera soils.

Tarrant soils have a surface layer of very dark grayish-brown cobbly clay about 8 inches thick. Below this is brown very cobbly clay, about 6 inches thick, that is about 80 percent limestone fragments. The underlying material is limestone bedrock.

Kavett soils have a surface layer of dark grayish-brown silty clay about 8 inches thick. Below this is brown silty clay about 8 inches thick. The underlying material is caliche-coated limestone.

Valera and Tobosa soils are in shallow valleys. Owens soils are on elongated scarps. Speck soils have the more gentle slopes.

Soils of this association are used mainly for range, but scattered, small areas of the deeper soils are cultivated. Cattle and sheep are raised on most ranches, and goats are raised on some.

This association is well suited to the production of wildlife.

2. Rumple association

Moderately deep, well-drained, moderately slowly permeable loamy soils over limestone

This association is a landscape characterized by complex surfaces that form low rounded hills and shallow valleys (fig. 3). Slopes are 2 to 8 percent.

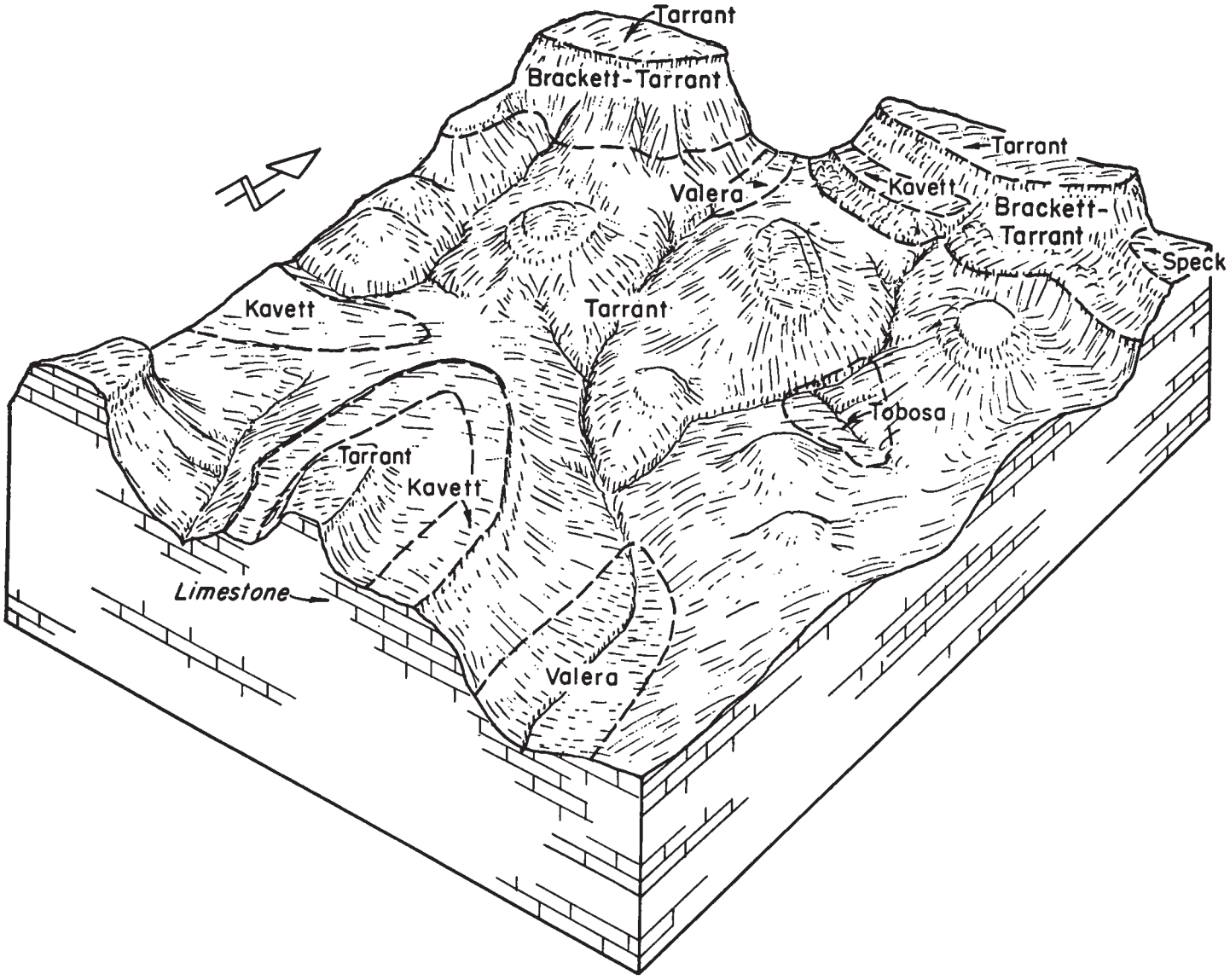

Figure 2.—Pattern of soils in Tarrant-Kavett association.

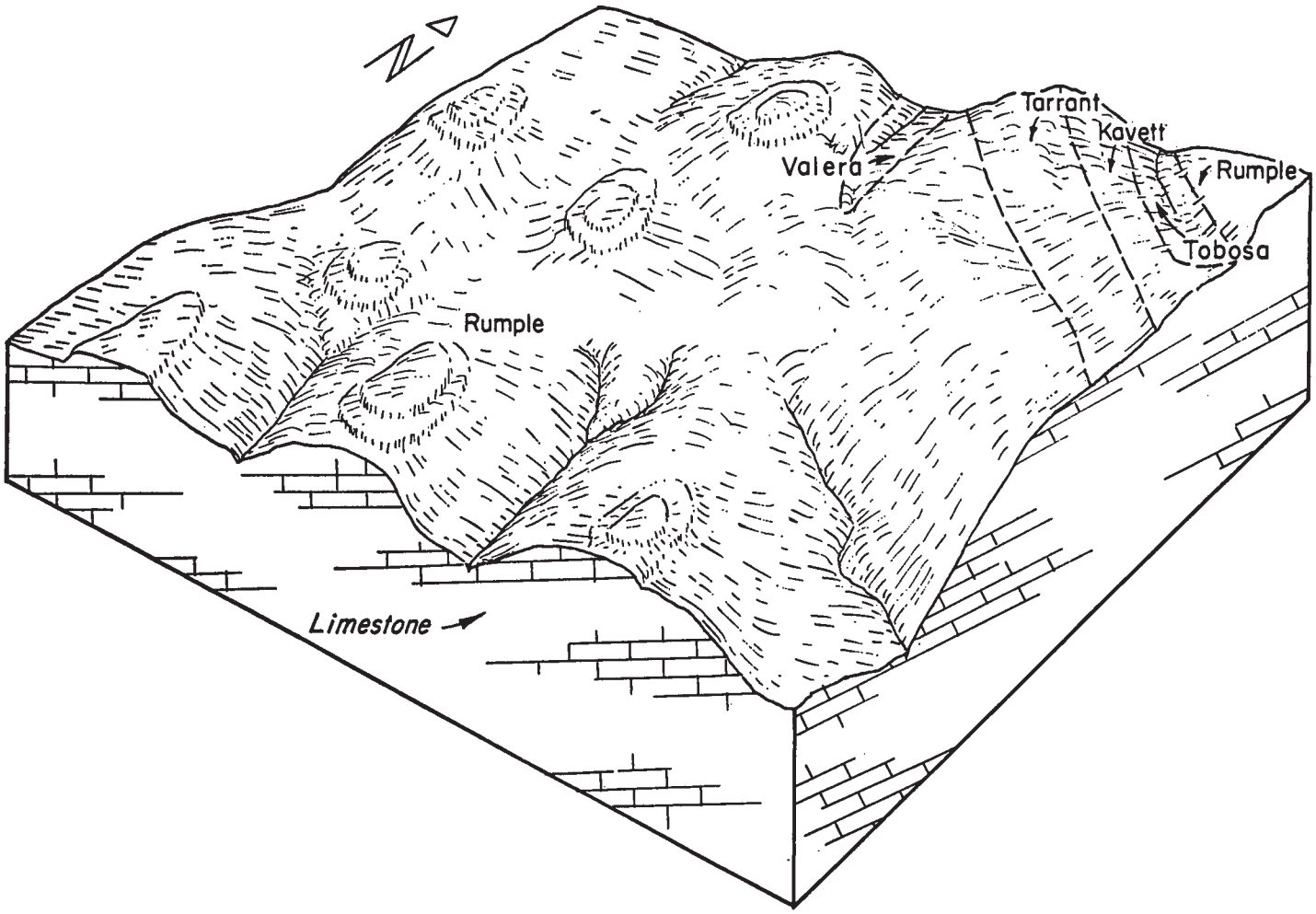

Figure 3.—**Pattern of soils in Rumple association.**

This association makes up about 4 percent of the county. It is about 90 percent Rumple soils and 10 percent Kavett, Tarrant, Tobosa, and Valera soils.

Rumple soils have a surface layer of dark reddish-brown cherty clay loam about 10 inches thick. The next layer is red very cherty clay about 16 inches thick. The underlying material is white and gray indurated limestone.

Kavett, Tarrant, Tobosa, and Valera soils occur mostly along the outer edges of the association.

This association is used for range.

3. *Acove-Cobb association*

Moderately deep, well-drained, moderately slowly and moderately permeable loamy soils over sandstone

This association is an undulating landscape broken by a few short scarps along deeply cut drainageways. Slopes are 1 to 12 percent.

This association makes up about 3 percent of the county. It is about 30 percent Acove soils, 26 percent Cobb soils, and 44 percent Bosque, Demona, Pontotoc, and Yates soils.

Acove soils have a surface layer of brown fine sandy loam about 15 inches thick. Below this is about 4 inches of yellowish-brown flaggy sandy clay loam. The next layer, about 19 inches thick, is flaggy clay. It is reddish yellow in the upper part and brownish yellow in the lower part. The underlying material is red, weakly cemented sandstone. Acove soils are on weakly oval shaped ridges and on hillsides of shallow valleys.

Cobb soils have a surface layer of brown fine sandy loam about 6 inches thick. Below this is about 6 inches of light reddish-brown fine sandy loam. The next layer, about 24 inches thick, is sandy clay loam. It is yellowish red in the upper part and reddish yellow in the lower part. The underlying material is reddish-yellow, fractured sandstone. Cobb soils are in natural drainageways and shallow valleys.

Bosque soils are along major drainageways. The gently undulating Demona soils are in broad valleys. Pontotoc soils are below short, steep sandstone scarps. Yates soils are in higher parts of the association.

Approximately 50 percent of the acreage is cultivated; the rest is range.

4. *Yates association*

Very shallow, well-drained, moderately permeable loamy soils over limestone

This association is an undulating landscape characterized by oval-shaped ridgetops and shallow valleys. Slopes are 1 to 8 percent.

This association makes up about 2 percent of the county. It is about 58 percent Yates soils and 42 percent Acove, Blanket, Cobb, and Pedernales soils.

Yates soils are about 6 inches of reddish-brown fine sandy loam overlying indurated, fractured limestone. They are on the crests and sides of ridges.

Acove soils are on low ridges and are underlain by sandstone. Blanket, Cobb, and Pedernales soils are in shallow valleys.

This association is used for range.

5. *Owens-Krum association*

Shallow to deep, well-drained, very slowly and moderately slowly permeable clayey soils over shale and alluvium

This association is an undulating landscape characterized by oblong areas ½ to 1½ miles wide and 4 to 6 miles long. Short, steep scarps are common. About 75 percent of the acreage has a waterworn gravel pavement. Slopes are dominantly 4 to 12 percent, but range up to 30 percent on scarps.

This association makes up about 1 percent of the county. It is about 50 percent Owens soils, 20 percent Krum soils, and 30 percent Bonti, Cho, Miles, Nuvalde, and Rochelle soils.

Owens soils have a surface layer of brown clay about 6 inches thick. The next layer, about 12 inches thick, is light olive-brown clay. The underlying material is pale-olive shale. These soils are commonly covered with gravel and limestone cobblestones and boulders.

Krum soils have a surface layer of dark grayish-brown silty clay about 8 inches thick. The next layer, about 34 inches thick, is brown silty clay. The underlying material is strong-brown silty clay. These soils are in natural drainageways.

Cho, Miles, Nuvalde, and Rochelle soils are scattered terrace remnants in the higher levels of the association. Bonti soils are associated with sandstone outcrops at the base of steep scarps.

This association is not well suited to cultivation. It is used for range.

6. *Bonti association*

Moderately deep, well-drained, moderately slowly permeable loamy soils over sandstone

This association consists mostly of soils on ridgetops and valley sides. Slopes are 1 to 10 percent.

This association makes up about 1 percent of the county. It is 60 percent Bonti soils and 40 percent Blanket, Cobb, Owens, Pedernales, and Tarrant soils.

Bonti soils have a surface layer of fine sandy loam about 11 inches thick. It is dark yellowish brown in the upper part and light brown in the lower part. Below this is about 6 inches of red clay. The next layer is yellowish-red sandy clay about 8 inches thick. The underlying material is brownish-yellow cemented sandstone. These soils are on ridges and in the upper parts of shallow valleys.

Owens soils are on scarps between Bonti soils and in shallow valleys. Pedernales soils are in the upper part of shallow valleys below narrow limestone ridges. Blanket soils are on the floors of shallow valleys. Tarrant soils overlie hard limestone on narrow discontinuous ridges. Cobb soils are mostly on shallow valley sides.

Most of this association is used for range. A few small areas are cultivated.

7. *Voca-Katemcy-Ligon association*

Deep to shallow, well-drained, slowly and moderately slowly permeable loamy soils over granite and schist

This association consists mostly of low ridges, oval-shaped ridgetops, and shallow valleys (fig. 4). Slopes range from 0 to 12 percent.

This association makes up about 1 percent of the county. It is about 40 percent Voca soils, 32 percent Katemcy soils, 24 percent Ligon soils, and about 4 percent Acove, Cobb, and Pedernales soils.

Voca soils have a 9-inch surface layer of gravelly sandy loam that is brown in the upper part and light brown in the lower part. The next layer is gravelly clay about 39 inches thick. It is dark red in the upper part and reddish brown in the lower part. The underlying material is granite. These soils are adjacent to and several feet lower than Katemcy and Ligon soils.

Katemcy soils have a surface layer of reddish-brown loam about 8 inches thick. The next layer is clay about 27 inches thick. It is red in the upper part and dark red in the lower part. The underlying material is light brownish-gray schist. These soils are in shallow valleys.

Ligon soils have a surface layer of reddish-brown loam about 5 inches thick. The next layer is dark-red clay loam about 11 inches thick. The underlying material is schist. Quartz gravel is common on the surface. These soils are on oval-shaped crests of ridges in the higher parts of the association. Katemcy and Ligon soils occur together in an undulating landscape.

Outcrops of schistose gneiss commonly occur as bands on Katemcy and Ligon soils. Outcrops of granite boulders are common on Voca soils.

Cobb and Pedernales soils are in shallow valleys. Acove soils are on low ridges.

This association is used for range. Farming the small arable acreages of Katemcy and Voca soils under current farming practices is not practical.

Dominantly Deep Soils

The soils in these areas are mainly underlain by recent or old alluvium. The landscape is mainly nearly level to gently sloping.

These soils are well suited to crops and range and to use as wildlife habitat. Cotton, small grain, and sorghum are the main crops. Cattle and sheep are the main livestock. Deer, turkeys, quail, and doves are the main wildlife.

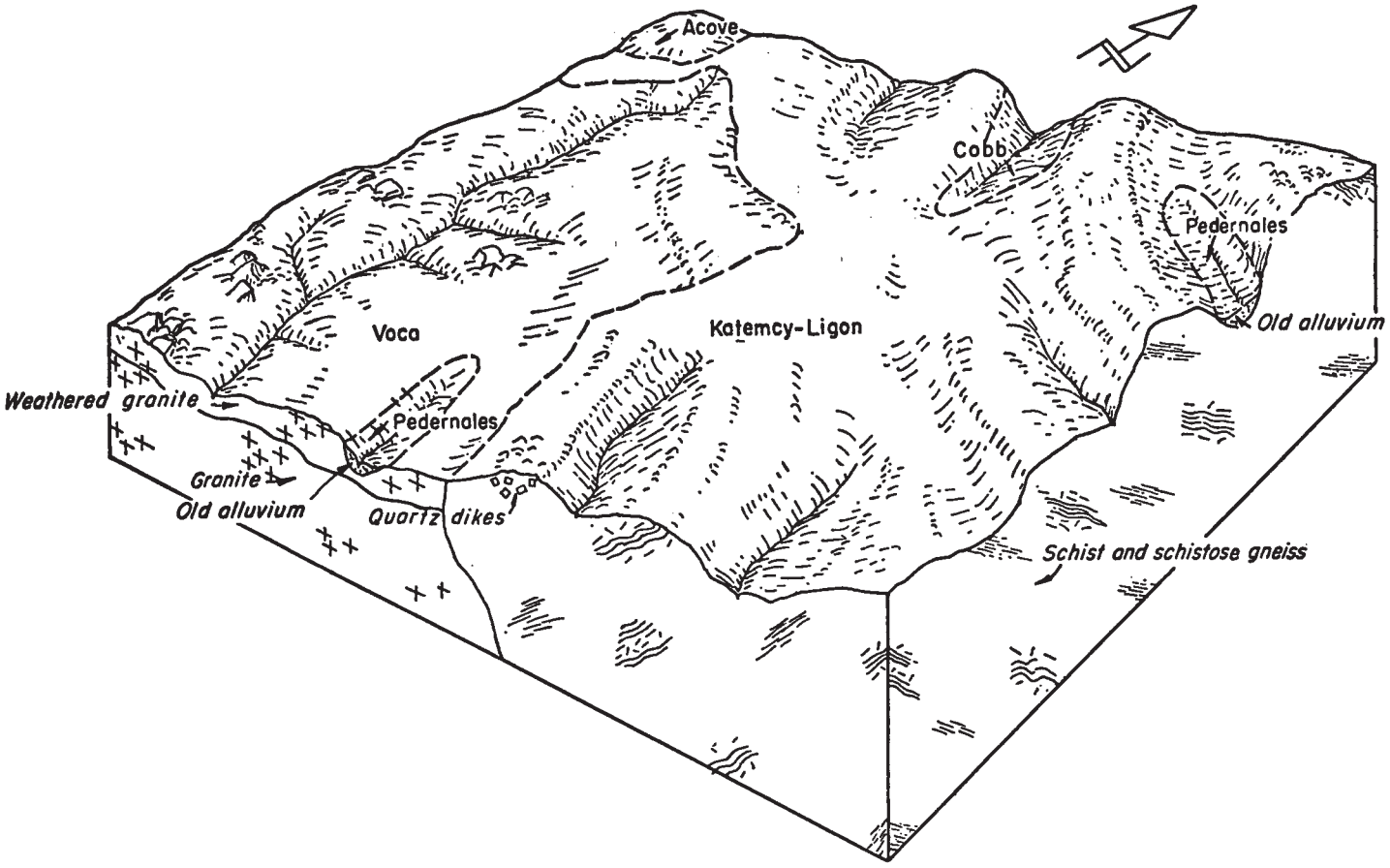

Figure 4.—**Pattern of soils in Voca-Katemcy-Ligon association.**

8. *Rowena-Mereta association*

Moderately deep to shallow, well-drained loamy soils that formed in old alluvium

This association is on outwash plains or old stream terraces that are dissected by shallow drainageways and broken by short scarps (fig. 5). Slopes are 0 to 3 percent.

This association makes up about 36 percent of the county. It is about 30 percent Rowena soils and about 20 percent Mereta soils. The rest is Cho, Frio, Nuvalde, Owens, Randall, Salga, and Tobosa soils.

Rowena soils have a surface layer of brown clay loam about 7 inches thick. The next layer is reddish-brown clay about 24 inches thick. The underlying material is reddish-yellow silty clay loam.

Mereta soils have a surface layer of dark grayish-brown clay loam about 5 inches thick. The next layer is dark-brown clay loam about 14 inches thick. The underlying material is caliche.

Nuvalde soils are a few feet higher on the landscape than Rowena soils. Salga soils are in positions similar to Rowena soils. Randall soils are in slightly lower lying rounded areas. Frio soils are along small streams. Cho soils are at a slightly higher elevation than other soils in the association. Owens soils occupy steep elongated scarps.

About 60 percent of the acreage of this association is cultivated. Some farms have small acreages in range. There are a few ranches.

9. *Pedernales-Sagerton-Clairemont association*

Deep, well-drained loamy soils that formed in recent and old alluvium

This association consists of soils on terraces and bottom land (fig. 6). Short scarps are between the terraces and bottom land. Slopes are dominantly 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 24 percent Pedernales soils, 16 percent Sagerton soils, 13 percent Clairemont soils, and 47 percent Miles, Rochelle, and Yahola soils.

Pedernales and Sagerton soils are on high terraces, and Clairemont soils are on bottom land.

Pedernales soils have a surface layer of brown fine sandy loam about 7 inches thick. Below this is sandy clay about 27 inches thick. It is reddish brown in the upper part and red in the lower part. The next layer is yellowish-red sandy clay loam.

Sagerton soils have a surface layer of brown clay loam about 13 inches thick. The next 12 inches is reddish-brown clay. The next layer is clay loam that is reddish brown in the upper part and reddish yellow in the lower part.

Clairemont soils have a surface layer of reddish-brown silt loam about 10 inches thick. Below this are reddish-brown to reddish-yellow stratified layers.

Miles soils are a few feet higher on the landscape than Pedernales and Sagerton soils, which are on high terraces. Rochelle soils are slightly above Pedernales and

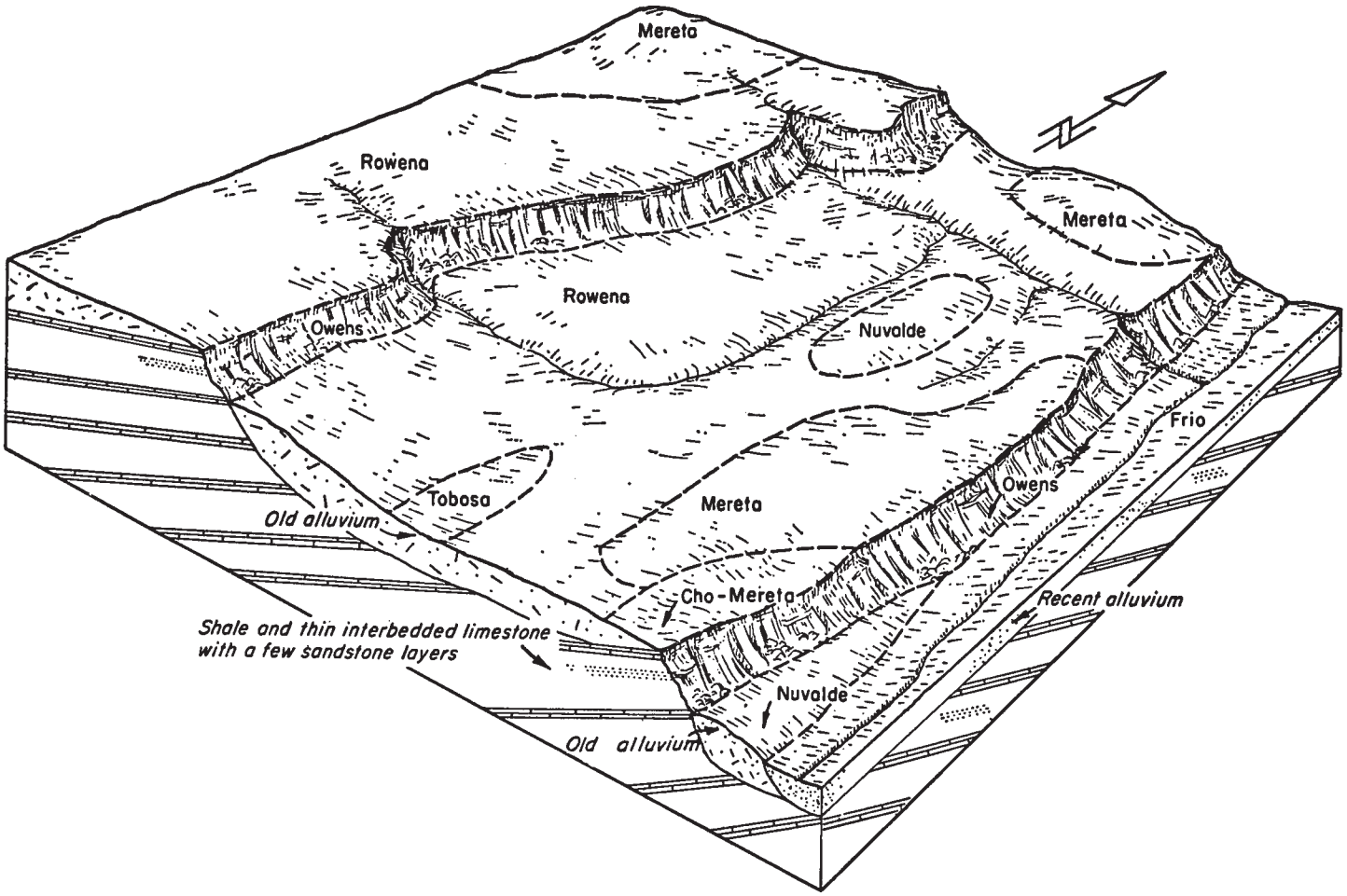

Figure 5.—**Pattern of soils in Rowena-Mereta association.**

Sagerton soils and near the edge of old high terraces. Yahola soils are on low, weakly oval shaped ridges on the flood plain.

Approximately 60 percent of the acreage of this association is cultivated, and 20 percent is nonarable because it is sloping or subject to frequent flooding. The other 10 percent is arable and is used for range.

10. Randall-Reap association

Deep, well-drained to somewhat poorly drained clayey soils that formed in old alluvium

This association is on uplands. Gilgai microrelief is common. Slopes are 0 to 3 percent.

This association makes up about 2 percent of the county. It is about 38 percent Randall soils, 32 percent Reap soils, and 20 percent Nuvalde, Rowena, and Tobosa soils.

Randall soils have a surface layer of dark-gray clay about 38 inches thick. Below this is gray clay. These soils are in the lower lying areas.

Reap soils have a surface layer of grayish-brown clay about 17 inches thick. Below this is brown clay. These soils are on microknolls and microridges.

Nuvalde and Rowena soils are at about the same position in the association. Randall and Tobosa soils are in small depressions.

The major soils of this association crack when dry. About 70 percent of the acreage is cultivated. The rest is used for range.

Descriptions of the Soils

This section describes the soil series and mapping units in McCulloch County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are

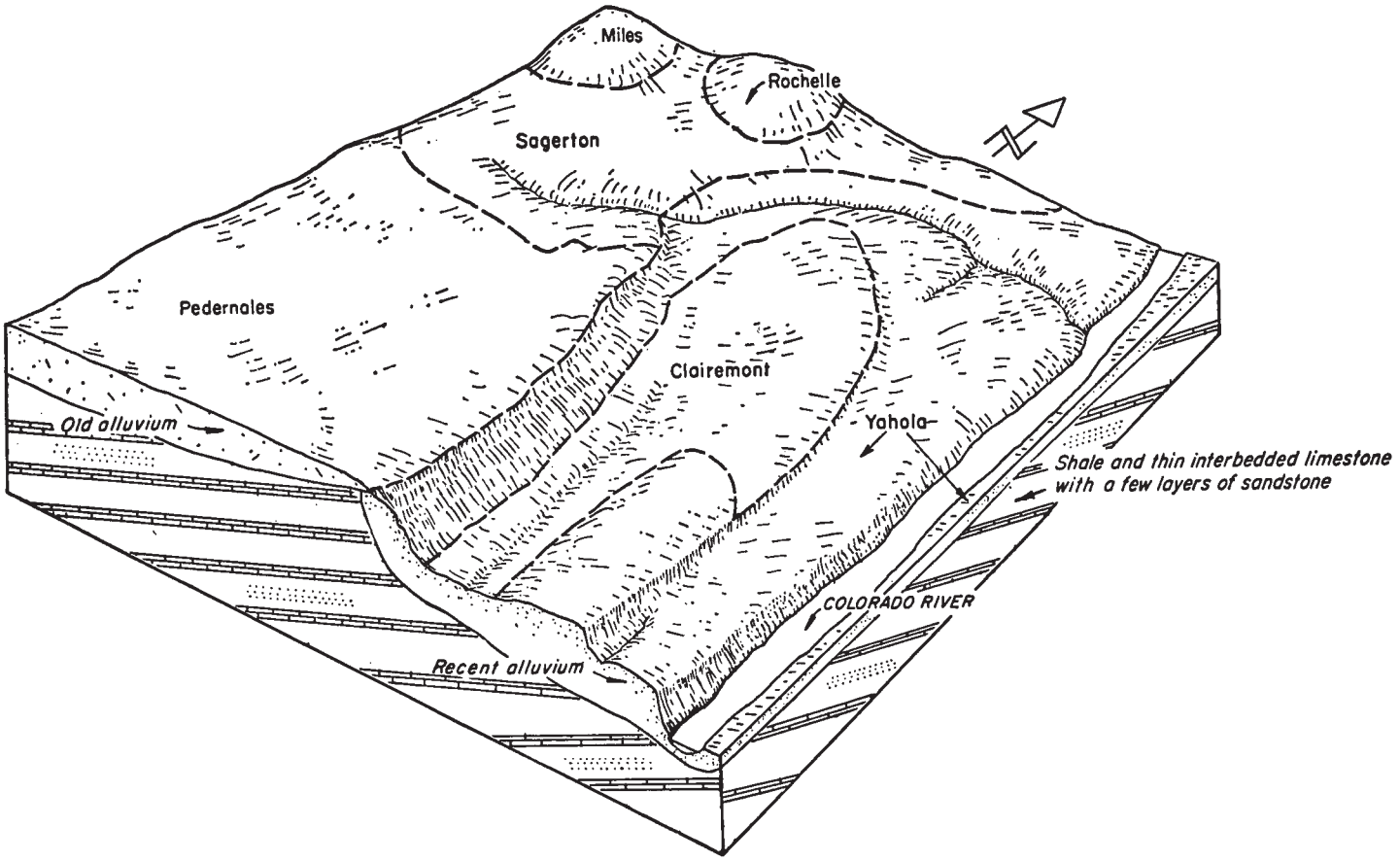

Figure 6.—**Pattern of soils in Pedernales-Sagerton-Clairemont association.**

those of a dry soil, and the percentage of coarse fragments is a volume measurement.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

Acove Series

The Acove series consists of gently undulating to rolling, well-drained, moderately deep soils on uplands. These soils formed in materials weathered from weakly consolidated sandstone. Surfaces are complex, and slopes are 1 to 12 percent.

In a representative profile the surface layer is brown fine sandy loam about 15 inches thick. The next 4 inches is yellowish-brown sandy clay loam that is about 65 percent strongly cemented, iron-enriched sandstone fragments. Below this is about 19 inches of clay that is reddish yellow in the upper part and brownish yellow in the lower part. At a depth of 38 inches is red, weakly cemented sandstone. Sandstone fragments that range from gravel to cobblestones in size and some boulders make up as much as 35 percent of the profile in some areas.

Internal drainage is slow, and permeability is moderately slow. Runoff is rapid. The available water capacity is low.

Acove soils are used mostly for range. Some of the acreage is farmed.

Representative profile of Acove fine sandy loam, 1 to 5 percent slopes, 12.9 miles south, 45 degrees east of the courthouse in Brady, or 90 yards north of Texas Highway No. 71 in a native pasture, one-half mile south and one-fourth mile east of Voca:

A11—0 to 9 inches, brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, coarse, granular structure; hard, very friable; many grass roots; many fine pores; few, fine, rounded quartz pebbles; few, fine, angular sandstone pebbles; neutral; gradual, smooth boundary.

A12—9 to 15 inches, brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, coarse, granular structure; hard, very friable; many grass roots; many fine pores; few, fine, rounded quartz pebbles; common, fine and medium, angular sandstone pebbles; slightly acid; clear, wavy boundary.

[1] Italic numbers in parentheses refer to Literature cited, p. 88.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area		Extent
	Medium intensity	Low intensity	
	Acres	*Acres*	*Percent*
Acove fine sandy loam, 1 to 5 percent slopes	4, 805		0. 7
Acove and Cobb soils, rolling		2, 210	. 3
Blanket clay loam, 1 to 2 percent slopes	2, 357		. 3
Bonti fine sandy loam, 1 to 5 percent slopes	1, 368		. 2
Bonti-Owens association, undulating		8, 353	1. 2
Bosque loam, neutral surface	657		. 1
Brackett loam, 1 to 5 percent slopes	3, 619		. 5
Brackett soils, 1 to 8 percent slopes	6, 517		1. 0
Brackett-Tarrant association, steep		10, 604	1. 6
Cho-Mereta association, gently undulating		17, 133	2. 5
Clairemont silt loam	4, 606		. 7
Cobb fine sandy loam, 1 to 3 percent slopes	4, 858		. 7
Demona loamy sand, 0 to 3 percent slopes	2, 301		. 3
Dev soils		2, 511	. 4
Frio clay loam	10, 006		1. 5
Frio clay loam, channeled	11, 495		1. 7
Karnes loam, 1 to 5 percent slopes	2, 845		. 4
Karnes loam, moderately shallow variant, 1 to 5 percent slopes	1, 822		. 3
Katemcy-Ligon association, undulating		5, 608	. 8
Kavett silty clay, 1 to 3 percent slopes	9, 180		1. 3
Krum silty clay, 1 to 3 percent slopes	2, 316		. 3
Latom soils, steep		1, 323	. 2
Mereta clay loam, 0 to 1 percent slopes	10, 024		1. 5
Mereta clay loam, 1 to 3 percent slopes	33, 176		4. 8
Miles fine sandy loam, 1 to 3 percent slopes	3, 095		. 5
Miller silty clay	1, 103		. 2
Nuvalde clay loam, 1 to 3 percent slopes	15, 096		2. 2
Nuvalde-Mereta complex, 2 to 5 percent slopes	4, 449		. 7
Owens-Blanket association, undulating		1, 863	. 2
Owens-Krum association, rolling		8, 137	1. 1
Owens and Tarrant soils, hilly		24, 973	3. 7
Pedernales fine sandy loam, 0 to 1 percent slopes	2, 339		. 3
Pedernales fine sandy loam, 1 to 3 percent slopes	6, 121		. 9
Pontotoc fine sandy loam, 1 to 5 percent slopes	471		. 1
Randall clay	1, 614		. 2
Randall-Reap complex	7, 964		1. 2
Reap-Tobosa complex, 1 to 3 percent slopes	3, 006		. 4
Rochelle fine sandy loam, 0 to 3 percent slopes	3, 044		. 4
Rowena clay loam, 0 to 1 percent slopes	25, 964		3. 8
Rowena clay loam, 1 to 3 percent slopes	47, 925		7. 0
Rumple association, undulating		28, 640	4. 1
Sagerton clay loam, 0 to 1 percent slopes	2, 437		. 4
Sagerton clay loam, 1 to 3 percent slopes	3, 042		. 4
Salga clay loam, 0 to 1 percent slopes	6, 216		. 9
Speck clay loam, 0 to 3 percent slopes	1, 291		. 2
Speck and Tarrant soils, gently undulating		3, 548	. 5
Tarrant soils, undulating		200, 340	29. 6
Tarrant-Kavett association, undulating		50, 711	7. 4
Tobosa clay, 0 to 1 percent slopes	11, 140		1. 6
Tobosa clay, 1 to 3 percent slopes	16, 429		2. 5
Valera clay, 1 to 3 percent slopes	22, 005		3. 2
Voca fine sandy loam, moderately shallow variant, 1 to 5 percent slopes	458		. 1
Voca gravelly sandy loam, 0 to 3 percent slopes	1, 286		. 2
Voca gravelly sandy loam, 3 to 12 percent slopes, severely eroded	1, 006		. 2
Yahola fine sandy loam	465		. 1
Yahola soils, strongly sloping		3, 672	. 5
Yates association, undulating		7, 982	1. 2
Total land area	677, 526		99. 3
Water	4, 714		. 7
Total	682, 240		100. 0

B1t—15 to 19 inches; yellowish-brown (10YR 5/4) flaggy sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate, fine, subangular blocky structure; very hard, friable, sticky and slightly plastic; many grass roots massed in soil fines; estimated 65 percent of horizon is platy and angular, strongly cemented, iron-enriched sandstone fragments; black pendants of iron-manganese that have reddish-brown interiors are on the lower side of many sandstone fragments; shiny clay films on ped surfaces and rock fragments; slightly acid; clear, wavy boundary.

B21t—19 to 25 inches, reddish-yellow (7.5YR 6/6) flaggy clay, strong brown (7.5YR 5/6) moist; moderate, fine, angular blocky structure; very hard, firm, sticky and plastic; common grass roots; about 30 percent of horizon is a discontinuous wavy layer of strongly cemented, reddish-brown, platy ironstone 0.5 to 2 inches thick and up to 14 inches across the long axis, mainly in the upper part of the horizon; continuous clay films on peds are slightly darker than ped interiors; slightly acid; clear, wavy boundary.

B22t—25 to 38 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; moderate, medium, angular blocky structure; very hard, very firm, sticky and plastic; few grass roots; estimated 10 percent of horizon is red (2.5YR 4/6) sandstone fragments 1 to 8 inches across the long axis and seemingly not oriented; continuous clay films on peds; thick yellowish clay films on sandstone fragments; dark-brown to black ferromanganese stains on lower faces of sandstone; few to common, weakly cemented ferromanganese concretions 5 to 10 millimeters in diameter; slightly acid; abrupt, wavy boundary.

C—38 to 64 inches, red (10R 4/6 and 2.5YR 4/6), weakly cemented but consolidated sandstone; few, yellow (10YR 7/6), strongly cemented sandstone plates up to three-fourths inch thick; few horizontal clay flows up to 2 inches thick in filled crevices; few very fine roots in clay flows in upper 6 inches; slightly acid.

The solum ranges from 24 to 40 inches in thickness. Reaction is neutral or slightly acid in the A horizon and slightly acid or medium acid in the Bt horizon. Coarse fragments in the A horizon range from a few sandstone pebbles, where slopes are 1 to 5 percent, to sandstone flags and gravel-size fragments that made up to 35 percent of the soil mass, where slopes are more than 5 percent.

The A horizon ranges from 8 to 18 inches in thickness, from fine sandy loam to loamy fine sand, exclusive of coarse fragments, and from brown to dark brown. The B1t horizon ranges from 3 to 6 inches in thickness and from gravelly or flaggy fine sandy loam to gravelly or flaggy sandy clay loam that is about 50 to 85 percent coarse fragments of reddish, platy and angular, strongly cemented, iron-bearing sandstone. The fragments are 1 to 15 centimeters thick and up to 60 centimeters across the long axis. The B1t horizon ranges from yellowish brown to reddish yellow. The B2t horizon ranges from 14 to 20 inches in thickness, from brownish yellow to reddish yellow, and from sandy clay to clay that is 5 to 20 percent red to yellowish-red, weakly cemented sandstone fragments 1 to 3 inches thick and 2 to 8 inches across the long axis. The C horizon is weakly cemented to strongly cemented, red to yellowish-brown, slightly acid sandstone.

Acove fine sandy loam, 1 to 5 percent slopes (AcC).—This soil is on low ridges. Areas are oblong to irregular in shape and are 50 to 200 acres in size. The landscape is gently undulating. Surfaces are complex, and slopes are dominantly about 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are Cobb, Demona, Pedernales, and Pontotoc soils in oblong to elongated shaped areas on foot slopes and along natural drainageways that border or dissect Acove soils. These inclusions are 1 to 5 acres in size and make up less than 15 percent of the total acreage of this Acove soil.

About 60 percent of the acreage of this Acove soil is cultivated. The rest is range. Dryland capability unit IVe–2; irrigated capability unit IVe–1; Sandy Loam range site.

Acove and Cobb soils, rolling (AlD).—This mapping unit is on the sides of narrow valleys and in areas that extend across narrow ridges. The landscape is dissected by drainageways. Areas are oblong to irregular in shape and are 20 to more than 300 acres in size. Surfaces are complex. Slopes are dominantly 3.5 to 10 percent, but range from 1 to 12 percent.

This mapping unit varies in composition. The Acove soil is dominant in all areas and makes up 50 to 70 percent of the mapping unit. The Cobb soil makes up 10 to 45 percent, but is not in all mapped areas. The average composition is 60 percent Acove soil, 25 percent Cobb soil, and 15 percent Demona, Pedernales, and Pontotoc soils and a stony soil that is similar to Pontotoc soil, but in some places is only 10 to 20 inches deep over sandstone and in others is less than 10 inches. There are also a few stony scarps where slopes are more than 12 percent.

Acove soils are on the upper sides of valleys and on ridgetops. Slopes are 1 to 12 percent. Cobb soils are on lower sides, foot slopes, and bottoms of shallow valleys where slopes are 1 to 3 percent. Demona, Pedernales, and Pontotoc soils occur as bands or elongated areas on foot slopes and in natural drainageways. The soil that is similar to the Pontotoc soil is on stony scarps near the bases of generally less sloping areas. The stony soil that is less than 10 inches deep is on cone-shaped and gently sloping ridgetops less than 300 feet wide. In a few nonstony areas Acove soils have slopes of 1 to 3.5 percent.

Scattered sandstone flags, stones, and boulders, or bands of these fragments, cover up to 40 percent of the surface area.

The Acove soil is as much as 35 percent sandstone fragments, flags, and boulders in most layers. It has a surface layer of brown flaggy fine sandy loam about 15 inches thick. The next 4 inches is yellowish-brown flaggy sandy clay loam and fragments of iron-enriched sandstone. The next layer, about 19 inches thick, is flaggy clay that is reddish yellow in the upper part and brownish yellow in the lower part. It is underlain by red, weakly cemented sandstone.

The Cobb soil has a surface layer of brown fine sandy loam about 6 inches thick. Below this is light reddish-brown fine sandy loam about 6 inches thick. The next layer is yellowish-red sandy clay loam about 16 inches thick. The next 8 inches is reddish-yellow sandy clay loam. It is underlain by reddish-yellow fractured sandstone.

The entire acreage is suited only to range. Dryland capability unit VIe–1; Sandstone Hill range site.

Blanket Series

The Blanket series consists of deep, well-drained, gently sloping soils in broad valleys of the uplands. These soils formed in calcareous loamy materials. Surfaces are plane to weakly concave, and slopes are 1 to 2 percent.

In a representative profile the surface layer is brown clay loam about 13 inches thick. The next 11 inches is brown clay loam. The next layer, about 20 inches thick, is reddish-brown clay loam in the upper part and yellowish-red clay loam in the lower part. It is underlain by reddish-yellow clay loam that contains threads and concretions of lime.

Runoff is slow, and permeability is moderately slow. The available water capacity is high.

Blanket soils are well suited to crops, and most areas are cultivated.

Representative profile of Blanket clay loam, 1 to 2 percent slopes, 12.1 miles south and 51 degrees east of the courthouse in Brady, in a cultivated field 16 feet south of field fence, 800 feet north and 200 feet west of a windmill, 1.1 miles northeast of Voca:

A1—6 to 13 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable; many fine roots; surface crust crushes easily; neutral; abrupt, smooth boundary.

A1—6 to 13 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine, subangular blocky structure; hard, friable; few fine roots; few fine pores; few worm casts; mildly alkaline; clear, smooth boundary.

B21t—13 to 24 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium, blocky structure; very hard, very firm; few fine pores; common distinct clay films on peds; mildly alkaline; gradual, smooth boundary.

B22t—24 to 36 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, very firm; few thin clay films on peds; few threads of lime in lower part; calcareous at a depth of 32 inches; moderately alkaline; gradual, smooth boundary.

B3—36 to 44 inches, yellowish-red (5YR 4/6) clay loam, yellowish red (5YR 3/6) moist; weak, medium, subangular blocky structure; hard, firm; common lime threads and few concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C—44 to 82 inches, reddish-yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; massive; hard, firm; common soft masses and concretions of calcium carbonate; many films and threads of lime; calcareous; moderately alkaline.

The solum ranges from 42 to 60 inches in thickness. Reaction is neutral or mildly alkaline in the upper part of the solum, and the soil is calcareous below a depth of 24 inches.

The A horizon ranges from 9 to 16 inches in thickness, from loam to clay loam, and from brown to dark grayish brown. The B2t horizon ranges from 16 to 32 inches in thickness and from reddish brown to dark grayish brown. It ranges from clay loam to sandy clay and is 35 to about 50 percent clay. The B3 horizon ranges from 6 to 12 inches in thickness, from clay to clay loam, and from reddish brown to brown. The C horizon ranges from calcareous loam to clay loam and is 10 to about 20 percent visible calcium carbonate. It ranges from reddish brown to brownish yellow.

Blanket clay loam, 1 to 2 percent slopes (BlB).—This soil is in areas that are irregular to oval in shape and 10 to 60 acres in size. Slopes are dominantly 1 to 1.5 percent.

Included with this soil in mapping are areas of Acove, Cobb, and Pedernales soils that are at slightly higher elevations than this Blanket soil. Also included are areas of Tobosa clay in natural drainageways slightly below this Blanket soil. These inclusions are 1 to 5 acres in size and make up less than 10 percent of the total acreage of this Blanket soil.

About 75 percent of the acreage is cultivated. The rest is used for range. Dryland capability unit IIe–2; irrigated capability unit IIe–2; Deep Upland range site.

Bonti Series

The Bonti series consists of well-drained, moderately deep soils on the tops and sides of ridges on uplands. These soils formed in material weathered from sandstone. Surfaces are complex, and slopes are dominantly 1 to 10 percent. In some areas sandstone fragments are on the surface and in the soil, and bedrock crops out intermittently. Other areas are free of sandstone fragments on the surface.

In a representative profile the surface layer is neutral, dark yellowish-brown fine sandy loam about 7 inches thick. The next 4 inches is light-brown fine sandy loam. Below this is red clay about 6 inches thick. The next layer is yellowish-red sandy clay about 8 inches thick. It is underlain by brownish-yellow, acid sandstone.

Internal drainage and permeability are moderately slow. Runoff is rapid. The available water capacity is low.

Bonti soils are used mostly for range, but a few small areas are farmed.

Representative profile of Bonti fine sandy loam, 1 to 5 percent slopes, 24 miles north, 32 degrees east of the courthouse in Brady; 0.4 mile southwest and 1.2 miles south from the junction of two county roads at Milburn, then 0.3 mile east in corner of field:

A1—0 to 7 inches, dark yellowish-brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak, fine, subangular blocky structure; hard, friable; many roots; one-fourth inch thick surface crust crushes easily; few strongly cemented sandstone fragments on the surface and in the soil; neutral; clear, smooth boundary.

A2—7 to 11 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak, very fine, subangular blocky structure; hard, friable; common roots; few sandstone fragments up to 3 inches in diameter and few cobblestones and flags 8 to 12 inches across long axis; slightly acid; abrupt, smooth boundary.

B21t—11 to 17 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine and medium, blocky structure; very hard, firm; few fine pores; few thin clay films on ped surfaces; medium acid; clear, smooth boundary.

B22t—17 to 25 inches, yellowish-red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) moist; few, medium, distinct, brownish-yellow mottles and few, fine, distinct, red mottles; moderate, fine and medium, blocky structure; very hard, firm; few pores; few thin clay films on ped surfaces; medium acid; abrupt boundary.

R—25 to 30 inches, brownish-yellow (10YR 6/6), strongly cemented, fractured, acid sandstone.

The solum thickness and depth to sandstone range from 20 to 40 inches. Sandstone fragments 20 inches across and up to 6 inches thick range from few to about 30 percent of the soil mass. Reaction is neutral or slightly acid in the A horizon and medium acid or strongly acid in the B2t horizon.

The A horizon ranges from fine sandy loam to loamy fine sand. The A1 horizon ranges from 3 to 7 inches in thickness and from brown to dark yellowish brown. The A2 horizon ranges from 2 to 6 inches in thickness and from light brown to very pale brown. The Bt horizon ranges from clay loam to clay. The B21t horizon ranges from 5 to 15 inches in thickness and from reddish brown to red. The B22t horizon ranges from 8 to 20 inches in thickness and from yellowish red to red. It has few to common mottles in shades of yellowish brown and red.

Bonti fine sandy loam, 1 to 5 percent slopes (BnC).—This soil is on the sides of shallow valleys adjacent to sandstone ridges. Areas are oblong to irregular in shape and are 10 to 60 acres in size. Surfaces are plane to concave, and slopes are dominantly 2 to 4 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping in most cultivated and retired fields are a few spots where the surface layer has been thinned by erosion and the upper subsoil has been mixed with the surface layer by plowing. Shallow gullies are in some fields. Also included are areas of Blanket, Cobb, Owens, and Pedernales soils. These included areas are oblong to irregular in shape and 1 to 5 acres in size.

Most areas of this Bonti soil are used for range. A few are used for crops. Most small fields that were formerly farmed have been returned to native pasture. The hazard of erosion is moderate. Dryland capability unit IIIe–3; irrigated capability unit IIIe–2; Tight Sandy Loam range site.

Bonti-Owens association, undulating (BOC).—This mapping unit is about 45 percent Bonti soil and 25 percent Owens soil. It is 30 percent Blanket, Cobb, Kavett, Latom, Mereta, Miles, Pedernales, Rochelle, Salga, Tarrant, and Valera soils, a Bonti soil that does not have stones on the surface, and a gravelly soil that formed in conglomerate. Bonti and Owens soils formed in material weathered from sandstone and shale. Areas are oblong to irregular in shape and are several hundred to more than 1,000 acres in size. The landscape is undulating. Surfaces are complex. The Bonti soil has slopes that range from 1.5 to 40 percent, but are dominantly 2.5 to 6 percent. The Owens soil has slopes that range from 5 to 30 percent, but are dominantly 8 to 20 percent.

Sandstone fragments make up as much as 30 percent of the Bonti soil and cover 30 to 75 percent of the surface. The surface layer is dark yellowish-brown fine sandy loam about 7 inches thick. The next 4 inches is light-brown fine sandy loam. Below this is red clay about 5 inches thick. The next layer, about 8 inches thick, is yellowish-red sandy clay. It is underlain by brownish-yellow sandstone.

On the Owens soil, sandstone fragments and conglomerate cobblestones and boulders cover 10 to 30 percent of the surface area. The surface layer is brown clay about 7 inches thick. The next layer, about 12 inches thick, is light olive-brown clay that contains a few secondary carbonates. It is underlain by weathered grayish-brown shale.

The Cobb, Miles, Pedernales, and nonstony Bonti soils are in shallow valleys below stony ridges. The Kavett, Latom, Mereta, and Tarrant soils are at the higher elevations, mostly on narrow ridges. The Blanket, Salga, and Valera soils are at lower elevations, mainly in natural drainageways. The Rochelle soils are on knobs and narrow ridges at the higher elevations. The soil that developed from conglomerate is on ridges southeast of Rochelle. It has a gravelly fine sandy loam surface layer and very gravelly sandy clay loam lower layers. There are numerous conglomerate cobblestones and boulders in the soil and on the surface. Outcrops of sandstone flags, cobblestones, and boulders are common throughout the greater part of the mapping unit. Limestone crops out on narrow ridges.

This association is used for range. Bonti soil: Dryland capability unit VIe–1; Sandstone Hill range site. Owens soil: Dryland capability unit VIIs–1; Shaly Hill range site.

Bosque Series

The Bosque series consists of deep, well-drained, nearly level soils on bottom land. These soils formed in loamy alluvium. Flooding occurs at 20- to 30-year intervals, but some low-lying areas near the channel are flooded as often as once in 1 to 5 years.

In a representative profile the surface layer is brown loam about 26 inches thick. The next layer is brown loam about 14 inches thick. It is underlain by brown loam and thin layers of fine sandy loam.

Permeability and internal drainage are moderate. Runoff is slow. The available water capacity is high.

Most areas of Bosque soils are used for range. A few are used for crops.

Representative profile of Bosque loam, neutral surface, 14.6 miles south and 58 degrees east of the courthouse in Brady, on the flood plain of Lost Creek, 40 yards west of old house, 1.2 miles north of county road, one-half mile south of Voca and 3.3 miles east:

A11—0 to 5 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, very fine, granular structure; slightly hard, friable; common roots; many pores; few earthworm channels; ¼ to ½ inch thick surface crust crushes easily; neutral; clear, smooth boundary.

A12—5 to 26 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; compound moderate, coarse, prismatic structure parting to moderate, very fine, subangular blocky structure; hard, friable; common roots; many pores; few earthworm channels; neutral; gradual, wavy boundary.

B2—26 to 40 inches, brown (7.5YR 4/4) loam, dark brown (7.5YR 3/4) moist; weak, fine, subangular blocky structure; hard, friable; few roots; many pores; few earthworm casts; faint bedding planes of brown fine sandy loam; few rounded quartz grains 1 to 3 millimeters in diameter; mildly alkaline; gradual, wavy boundary.

C—40 to 65 inches, brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; massive; hard, friable; few roots; many pores; common films and threads of lime; few earthworm casts; thin bedding planes of fine sandy loam; calcareous; moderately alkaline.

The texture between depths of 10 and 40 inches generally ranges from loam to clay loam and is 22 to 35 percent clay. Reaction ranges from neutral to moderately alkaline.

The B2 horizon ranges from 22 to 40 inches in thickness and from brown to dark brown. The B horizon ranges from 10 to 18 inches in thickness and from dark brown to light brown. The C horizon is loam or sandy clay loam and ranges from brown to pale brown.

Bosque loam, neutral surface (Br).—This nearly level soil is on flood plains. Areas are oblong to elongated in shape and are 10 to 90 acres in size. They are oriented with streamflow. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.5 percent.

Included with this soil in mapping are a few areas that have a deposit of fine sandy loam up to 18 inches thick on the surface. These are elongated areas 1 to 5 acres in size near drainageways. Also included are some areas of Bosque soils that have slopes of more than 1 percent.

About 10 percent of the acreage of this Bosque soil is cultivated. The rest is used for range. Dryland capability

unit IIc–4; irrigated capability unit I–5; Bottomland range site.

Brackett Series

The Brackett series consists of well-drained, shallow, gently sloping to steep soils on uplands. These soils are on low-lying ridges, foot slopes, and hilly scarps. They formed in material weathered from thin-bedded limestone. Slopes are 8 to 45 percent on scarps and 1 to 8 percent elsewhere.

In a representative profile the surface layer is grayish-brown, calcareous loam about 6 inches thick. The next layer is brown, calcareous loam about 11 inches thick. At a depth of 17 inches is pale-yellow loam and many soft lime masses and thin-bedded limestone.

Internal drainage and permeability are moderately slow. Runoff is rapid. The available water capacity is low.

Most areas of Brackett soils are used for range. A few are cultivated.

Representative profile of Brackett loam, 1 to 5 percent slopes, 10.2 miles north, 66 degrees west of the courthouse in Brady, in native pasture 50 yards north of fence, 0.4 mile east from the intersection of the Whiteland road and U.S. Highway No. 190:

A1—0 to 6 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, very fine, subangular blocky and granular structure; hard, firm; common grass roots; many pores; few limestone fragments; common worm casts; calcareous; moderately alkaline; clear, wavy boundary.

B2—6 to 17 inches, brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate, very fine, subangular blocky structure; hard, firm but crumbly; many roots; many pores; common earthworm casts; about 5 to 10 percent subrounded limestone fragments that have nodular calcium carbonate coatings 10 to 20 millimeters in diameter; many lime specks; few concretions of calcium carbonate; grayish-brown staining along root channels; calcareous; moderately alkaline; abrupt, irregular boundary.

C—17 to 60 inches, pale-yellow (2.5Y 8/4) loam, pale yellow (2.5YR 7/5) moist, and thin-bedded weakly to strongly cemented limestone; few roots in upper part between plates; many soft lime masses and lenses; mass is about 50 percent lime.

The solum ranges from 10 to 20 inches in thickness. Weakly to strongly cemented limestone fragments range from few to as much as 35 percent of the soil mass, and from gravel size to 5 inches in diameter.

The A horizon ranges from 5 to 8 inches in thickness and from clay loam to gravelly loam, gravelly clay loam, or loam. It ranges from light brownish gray or grayish brown to light yellowish brown. The B horizon ranges from 5 to 12 inches in thickness; from loam to gravelly loam, gravelly clay loam, or clay loam; and from brown to pale yellow. The C horizon is limy loam to clay loam and 25 to about 50 percent thin-bedded limestone. This horizon is white to pale yellow.

Brackett loam, 1 to 5 percent slopes (BsC).—This soil is on low ridges and foot slopes in broad valleys. It is in oblong to elongated areas 10 to 100 acres in size, generally about 20 acres. Slope is dominantly near 3 percent. This soil has the profile described as representative of the series (fig. 7).

Included with this soil in mapping are areas of Kavett, Tarrant, and Valera soils and Karnes loam, moderately shallow variant. Also included are areas of Brackett soils that are 15 to 35 percent limestone gravel. The Karnes soils are in positions similar to Brackett soils. Tarrant soils are on low ridges and knobs. Kavett and Valera soils are in natural drainageways and low-lying areas. These inclusions are 1 to 5 acres in size. The Karnes soils and the gravelly Brackett soils make up as much as 10 percent of the total acreage of this Brackett soil, and the other soils not more than 5 percent.

Figure 7.—**Profile of Brackett loam, 1 to 5 percent slopes.**

This Brackett soil is not well suited to cultivation. Cultivated acreages are less than 10 acres in size and are in fields adjacent to more productive soils. Most of the acreage is used for range. Dryland capability unit IVe–1; Adobe range site.

Brackett soils, 1 to 8 percent slopes (BtC).—These undulating soils are in broad valleys of the uplands. Areas

are oblong to irregular in shape and are 10 to 200 acres in size. Surfaces are complex. Slopes range from 1 to 8 percent, but are dominantly 2 to 6 percent.

In a representative profile the surface layer is light brownish-gray gravelly loam or gravelly clay loam, about 5 inches thick, that is 15 to 35 percent limestone fragments of gravel size. Angular and subrounded limestone fragments that range from gravel to small cobblestones in size cover 25 to 50 percent of the surface area. The next layer, about 8 inches thick, is brown gravelly loam. The underlying material is pale-brown loam.

Included with these soils in mapping are areas of Karnes, Kavett, Tarrant, and Valera soils and exposures, 1 to 3 acres in size, of geological material of raw clay and marly earth on short scarps. Tarrant soils are on crests of ridges and caps of low rounded hills. Kavett and Valera soils are over limestone on benches and in shallow valleys or draws. Karnes soils are on low rounded rises and foot slopes. These inclusions are 1 to 10 acres in size and make up as much as 10 percent of the total acreage of these Brackett soils.

The entire acreage is used for range. The high lime content causes nutrient unbalance that limits the quality of forage. Dryland capability unit VIs–1; Adobe range site.

Brackett-Tarrant association, steep (BUE).—This mapping unit is on scarps that border undulating limestone uplands. It is 52 percent Brackett soil, 30 percent Tarrant soil, and 18 percent Karnes, Kavett, and Owens soils and a deep soil that is more than 35 percent coarse fragments in the lower layers. Areas are 100 to more than 1,000 acres in size and generally are several miles in length. Surfaces are complex. Slopes range from 8 to about 45 percent and are dominantly 20 to 40 percent (fig. 8).

The Tarrant soil occupies the higher positions on the landscape, and the Brackett soil lies immediately below.

The Brackett soil has a surface layer of grayish-brown gravelly loam, about 5 inches thick, that is about 35 percent limestone fragments. The next layer is brown gravelly loam about 9 inches thick. The underlying material is pale-yellow loam.

The Tarrant soil has a surface layer of very dark grayish-brown cobbly clay, about 8 inches thick, that is about 40 percent limestone ranging from fragment size to boulders. The next layer is brown very cobbly clay, about 6 inches thick, that is up to about 80 percent limestone fragments mostly less than 3 inches in diameter. It is underlain by fractured limestone bedrock.

Figure 8.—Brackett-Tarrant association, steep.

The deep soil is in oval to oblong areas 1 to 5 acres in size. The steep Owens soil is on short scarps 2 to 10 acres in size. The nearly level Kavett soil is on benches 1 to 10 acres in size. The Karnes soil occurs as elongated bands 3 to 8 acres in size.

Geological and accelerated erosion has removed most of the surface layer on some slight knobs between deeply cut drainageways. Raw geological material is exposed on a few almost vertical faces of scarps. About 10 to 15 percent of the Brackett soil in this mapping unit is eroded.

The entire acreage is used for range. Cows seldom graze the steeper slopes, but goats and sheep adapt well to the site. Dryland capability unit VIIs–1; Brackett soil in Adobe range site, Tarrant soil in Low Stony Hill range site.

Cho Series

The Cho series consists of well-drained soils that are shallow to very shallow over caliche. These soils are on low weakly convex ridges. They formed in old alluvium. Surfaces are plane to complex, and slopes are 1 to 5 percent. Caliche fragments cover about 5 to 10 percent of the surface area and make up about 10 percent of the soil mass.

In a representative profile the surface layer, about 10 inches thick, is brown loam that contains a few caliche fragments. The underlying indurated caliche layer is pinkish white and is about 4 inches thick. It is underlain by thick beds of pink, limy earth of about loam texture.

Permeability is slow in the cemented caliche. Runoff is slow. The available water capacity is low.

Most areas of Cho soils are used for range. A few are cultivated.

Representative profile of Cho loam in an area of Cho-Mereta association, gently undulating, 26.5 miles north and 36 degrees west of the courthouse in Brady, or 200 feet northwest of pasture trail, 3.7 miles north of Doole on Farm Road 503, to pasture gate, then 0.4 mile northeast:

A1—0 to 10 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak, fine, granular structure and weak, medium, subangular blocky structure; slightly hard, friable; many fine roots; common fine pores; about 5 percent surface covering of caliche fragments; about 10 percent caliche fragments in soil; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—10 to 14 inches, pinkish-white (7.5YR 8/2) indurated caliche, broken into plates 6 to 18 inches across by 1 to 2 inches thick, laminar in upper part; about 5 percent brown loam between plates and in solution channels; clear, wavy boundary.

C2ca—14 to 60 inches, pink (7.5YR 8/4) limy earth of about loam texture; massive; hard, friable; estimated more than 50 percent calcium carbonate; 20 to 30 percent concretions and caliche fragments; calcareous; moderately alkaline.

The solum thickness, or depth to the cemented caliche layer, ranges from 7 to 20 inches. The solum ranges from loam or gravelly loam to clay loam and is 20 to 35 percent clay. It ranges from brown to dark grayish brown. The content of coarse fragments ranges from 5 to 30 percent. The C1cam layer ranges from 2 to 10 inches in thickness, from platy to massive, and from pink to pinkish white. The C2ca horizon ranges from a few to several feet in thickness, from pinkish white and pink to very pale brown, and from loam to clay loam. It is high in content of calcium carbonate. The C2ca layer contains dispersions and layers of gravel.

Cho-Mereta association, gently undulating (CMB).—This mapping unit is on old alluvial plains on upland ridges. It is about 60 percent Cho soil, 30 percent Mereta soil, and 10 percent Nuvalde and Rowena soils, limestone outcrops, a few short choppy scarps that have slopes of more than 4 percent, and thin limestone ledges that outcrop at lower elevations on Cho soils. Areas are oblong to irregular in shape and are several hundred acres in size. The Mereta soil generally is in oval to oblong areas of less than 1 acre in size, interspersed in a matrix of Cho soils. Surfaces are plane to complex. Slopes are dominantly 1.5 to 3.5 percent, but range from 1 to 5 percent.

The Cho soil has the profile described as representative of the series.

The Mereta soil has a surface layer of dark grayish-brown clay loam about 5 inches thick. The next layer is dark-brown clay loam about 14 inches thick. Below this is a 4-inch layer of cemented caliche underlain by soft pink caliche that is more than 50 percent lime.

The thin limestone ridges are a few yards wide and up to one-fourth mile long. Nuvalde and Rowena soils are in natural drainageways and at lower elevations, and areas are 1 to 10 acres in size.

Most of the acreage is used for range. Small areas in fields with other soils are cultivated. Many areas formerly cultivated have been returned to range. The hazard of erosion is moderate where there is no protective cover. Some Cho soils are mined for caliche for roadbed material. Dryland capability unit VIs–1; Cho soil in Very Shallow range site, Mereta soil in Shallow range site.

Clairemont Series

The Clairemont series consists of deep, well-drained, nearly level soils on flood plains. These soils formed in alluvial sediments. Areas are oblong to elongated in shape and are oriented with streamflow. Slopes are 0 to 1 percent.

In a representative profile the surface layer is reddish-brown silt loam about 10 inches thick. The next layer is reddish-brown silty clay loam about 26 inches thick. The underlying material is reddish-brown silt loam.

Permeability is moderate. Runoff is slow. The available water capacity is high.

Most areas of these Clairemont soils are used for crops. A few are still in native range.

Representative profile of Clairemont silt loam, 28 miles north and 32 degrees west of the courthouse in Brady, in a cultivated field 100 yards east of the junction of two fences, 1.3 miles east and 0.5 mile north from Stacy Post Office on Farm Road 503:

Ap—0 to 6 inches, reddish-brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; weak, very fine, granular structure; hard, friable; few roots; porous; surface inch is loam; surface crust one-eighth inch thick crushes easily; surface clods melt down with rain; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 10 inches, reddish-brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; compound coarse, prismatic structure and weak to moderate, very fine, subangular blocky structure; hard, friable; few roots; few pores; compacted plow layer; few earth-

worm channels and casts; calcareous; moderately alkaline; clear, smooth boundary.

C1—10 to 36 inches, reddish-brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable; common fine and medium pores; thin strata of fine sandy loam and loam; fragments have dull faces; bedding planes are evident; few earthworm channels and casts; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C2—36 to 60 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; hard, friable; common fine pores; thin strata of silty clay loam and fine sandy loam; bedding planes are evident; few films and threads of calcium carbonate; few waterworn siliceous pebbles in the lower 12 inches; calcareous; moderately alkaline.

The A horizon ranges from 6 to 14 inches in thickness and from yellowish red to reddish brown. The C horizon, to a depth of 40 inches or more, ranges from reddish brown to reddish yellow. Between depths of 10 to 40 inches it ranges from loam to silty clay loam and is 18 to 35 percent clay.

Clairemont silt loam (Cn).—This nearly level soil is on flood plains. Areas are oblong to elongated in shape and are 20 to 150 acres in size. Slope is dominantly about 0.5 percent but ranges to 1 percent. Flooding occurs once in about 30 years.

Included with this soil in mapping are areas of Miller and Yahola soils. Yahola soils are on low, weakly convex rises slightly above Clairemont soils. Miller soils are on elongated, weakly concave positions, slightly lower than Clairmont soils. Inclusions of Miller soils are less than 5 acres in size, and inclusions of Yahola soils are 5 to 10 acres in size.

About 85 percent of the acreage of this Clairemont soil is cultivated. Dryland capability unit IIc–4; irrigated capability unit I–5; Loamy Bottomland range site.

Cobb Series

The Cobb series consists of well-drained, moderately deep, gently sloping soils on uplands. These soils formed in material weathered from sandstone. Surfaces are plane to complex, and slopes are 1 to 3 percent.

In a representative profile the upper 6 inches of the surface layer is brown fine sandy loam, and the lower 6 inches is light reddish-brown fine sandy loam. The next layer, about 16 inches thick, is yellowish-red sandy clay loam. Below this is reddish-yellow sandy clay loam about 8 inches thick. At a depth of 36 inches is reddish-yellow, fractured sandstone.

Permeability and internal drainage are moderate. Runoff is slow to medium. The available water capacity is moderate.

Most areas of Cobb soils are cultivated. A few are in native range.

Representative profile of Cobb fine sandy loam, 1 to 3 percent slopes, 13.8 miles south, 40 degrees east of the courthouse in Brady, in a cultivated field 50 feet east of county road, 3.3 miles south of Voca on Ranch Road 1851:

Ap—0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak, very fine, granular structure; slightly hard, friable; common coarse sand grains as a result of winnowing; slightly acid; abrupt, smooth boundary.

A1—6 to 12 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; coarse prismatic structure parting to weak, fine, subangular blocky structure; hard, friable; porous; few quartz grains; slightly acid; clear, smooth boundary.

B21t—12 to 28 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; coarse prismatic structure parting to moderate, very fine, subangular blocky structure; very hard, firm; few thin clay films; few ferromanganese concretions; few sandstone fragments; slightly acid; gradual, smooth boundary.

B22t—28 to 36 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; coarse prismatic structure parting to moderate, medium and coarse, blocky structure; hard, firm; few thin clay films; few ferromanganese concretions; about 10 percent red and yellowish-red sandstone fragments in lower 3 inches; slightly acid; abrupt, wavy boundary.

C—36 to 40 inches, reddish-yellow (7.5YR 7/6) fractured sandstone that has yellowish outer crust; slightly acid.

The solum ranges from 20 to 40 inches in thickness. Reaction is slightly acid or neutral in the A horizon and ranges from medium acid to neutral below this horizon.

The A horizon ranges from light reddish brown or reddish brown to brown and from 6 to 12 inches in thickness. It is mainly fine sandy loam but ranges to loamy fine sand. The B21t horizon ranges from reddish brown to yellowish red and from 7 to 18 inches in thickness. The B22t horizon ranges from reddish brown to reddish yellow and from 6 to 18 inches in thickness. The Bt horizon ranges from clay loam to sandy clay loam and has a clay content of 18 to 35 percent. The underlying sandstone bedrock is weakly cemented to strongly cemented.

Cobb fine sandy loam, 1 to 3 percent slopes (CoB).—This soil is on low valley sides. Areas are oblong to irregular in shape and are 25 to about 300 acres in size. The landscape is undulating. Surfaces are complex, and slopes are dominantly 1.5 to 2.5 percent.

Included with this soil in mapping are areas of Demona and Pedernales soils in natural drainageways and along basal slopes below Cobb soils and areas of Acove soils on low ridges and isolated knobs a few feet higher on the landscape than Cobb soils. Also included are a few areas where slopes are 4 percent. These inclusions are 1 to 5 acres in size and make up less than 15 percent of the total acreage of this Cobb soil.

Most areas of this Cobb soil are cultivated. Dryland capability unit IIe–1; irrigated capability unit IIe–1; Sandy Loam range site.

Demona Series

The Demona series consists of deep, nearly level to gently sloping, moderately well drained soils in drainageways in the uplands. These soils formed in material weathered from thin-bedded sandstone and shale.

In a representative profile the surface layer is brown loamy sand about 18 inches thick. The next 8 inches is light yellowish-brown loamy sand. The next layer is brownish-yellow, mottled sandy clay about 36 inches thick. The underlying material is thin-bedded sandy shale and sandstone.

Internal drainage and permeability are moderately slow. Runoff is slow to medium. The available water capacity is moderate.

Most of the acreage of Demona soils is farmed. A few areas are in native range.

Representative profile of Demona loamy sand, 0 to 3 percent slopes, 13.9 miles south and 30 degrees east of the courthouse in Brady, in a cultivated field 100 feet

west of county road, 0.5 mile southeast of the San Saba River bridge on Texas Highway No. 71, then 2.5 miles south on county road:

Ap—0 to 6 inches, brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; single grain; slightly hard, very friable; few sandstone and quartz pebbles; neutral; abrupt boundary.

A1—6 to 18 inches, brown (10YR 4/3) loamy sand, brown (10YR 4/3) moist; single grain; hard, very friable; common fine and medium pores; few rounded quartz pebbles; neutral; clear, wavy boundary.

A2—18 to 26 inches, light yellowish-brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grain; hard, friable; common fine pores; few rounded quartz grains 1 to 5 millimeters in diameter; neutral; clear, wavy boundary.

B2t—26 to 50 inches, brownish-yellow (10YR 6/8) sandy clay, yellowish brown (10YR 5/8) moist; many, medium, distinct mottles that have moist colors of grayish brown (10YR 5/2), yellowish red (5YR 4/8), and grayish brown (2.5Y 5/2) and some outer ped surface coloring of very dark gray (10YR 3/1); moderate, medium, blocky structure; very hard, very firm; few thin clay films on peds; few ferromanganese concretions 2 to 5 millimeters in diameter; few rounded quartz grains 1 to 5 millimeters in diameter; medium acid; gradual, wavy boundary.

B3t—50 to 62 inches, brownish-yellow (10YR 6/8) sandy clay, yellowish brown (10YR 5/8) moist; common, fine, distinct mottles of dark red (2.5YR 3/6) moist and outer ped coloring of light gray (10YR 6/1) moist; moderate, medium, blocky structure; very hard, firm; few thin clay films on peds; common quartz grains 2 to 5 millimeters in diameter; medium acid; clear, wavy boundary.

C—62 to 80 inches, sandy shale and thin-bedded yellowish-red (5YR 4/6) sandstone, brown (7.5YR 4/4) and light yellowish brown (2.5Y 6/4) moist; massive; medium acid.

The solum ranges from 50 to 80 inches in thickness. Reaction ranges from neutral to medium acid in the A horizon.

The Ap and A1 horizons are 12 to 20 inches thick and range from brown to pale brown. The A2 horizon ranges from 8 to 15 inches in thickness and from light yellowish brown to pale brown. The B2t horizon is 20 to 30 inches thick, ranges from brownish yellow to reddish yellow, and contains common or many mottles. The B3t horizon ranges from 10 to 15 inches in thickness, from sandy clay to clay loam, and from brownish yellow to reddish yellow. It contains mottles similar to those in the B2t horizon. The C horizon is brown, light-brown, and light yellowish-brown sandy clay and sandy shale interbedded with yellowish-red sandstone.

Demona loamy sand, 0 to 3 percent slopes (DeB).—This soil is in broad valleys. Areas are oblong to irregular in shape and are 20 to 100 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 1 to 1.5 percent.

Included with this soil in mapping are areas of Acove and Cobb soils. These inclusions are oblong to elongated areas 2 to 10 acres in size. They are on low ridges above Demona soils.

Most of the acreage of this Demona soil is used for crops (fig. 9). Dryland capability unit IIIe–4; irrigated capability unit IIIe–3; Sandy range site.

Dev Series

The Dev series consists of deep, well-drained soils on bottom land where high gradient streams drain the limestone uplands. These soils formed in alluvial sediments. They are subject to frequent flooding, which causes scouring and deposition in many places. Slopes are 0 to 2 percent.

In a representative profile the surface layer is very dark grayish-brown very gravelly clay loam about 28 inches thick. The underlying material is very pale brown very gravelly clay loam.

Permeability is moderately rapid. Runoff is slow to medium. The available water capacity is low.

Dev soils are used for range.

Representative profile of Dev soils 17.6 miles south, 51 degrees west of the courthouse in Brady, 2 miles south of pavement on Calf Creek, 1.4 miles south of the courthouse in Brady on U.S. Highway No. 87, then 16.8 miles southwest on Ranch Road 42:

A1—0 to 28 inches, very dark grayish-brown (10YR 3/2) very gravelly clay loam, very dark brown (10YR 2/2) moist; moderate, fine and very fine, subangular blocky and granular structure; hard, firm; common roots; about 55 percent angular and subrounded limestone gravel mostly ⅛ to 2 inches in diameter; few cobblestones and stones up to 8 inches across long axis; many lime specks; calcareous; moderately alkaline; diffuse boundary.

Cca—28 to 60 inches, very pale brown (10YR 7/4) very gravelly clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable; about 70 percent subrounded limestone gravel, mostly ⅛ inch to 1½ inches in diameter but ranging to 3 inches; few cobblestones and stones up to 10 inches across long axis; common gravel stratum 1 to 6 inches thick that is 5 percent or less of soil fines; few threads and thin films of calcium carbonate on pebbles; calcareous; moderately alkaline.

Depth to limestone rubble or bedrock is 48 to 60 inches. Layers of nearly all coarse fragments are common throughout the soil. Layers 1 to 4 inches thick and less than 35 percent coarse fragments are in the A horizon of some profiles. The solum is 50 to 90 percent well-graded limestone fragments 3 inches or less in diameter. Cobblestones and stone-size limestone are common throughout the soil.

The A1 horizon ranges from 24 to 40 inches in thickness, from very dark grayish brown to brown, and from very gravelly loam to very gravelly clay loam. The Cca horizon ranges from brown to very pale brown and from very gravelly loam to very gravelly clay loam.

Dev soils (DV).—These alluvial soils occur as oblong to elongated bands 50 to 100 yards wide and up to 60 acres in size. In many places they are cut by a meandering channel. Slopes are 0 to 2 percent.

Areas of Frio, Karnes, and Nuvalde soils 1 to 5 acres in size are included with these soils in mapping. Frio soils are on the flood plain above the Dev soils and other inclusions. Also included are stream channels that have short steep sides and scour channels, 10 to 50 feet wide, along which slopes are 3 to 8 percent. Floods occur once or twice a year.

Dev soils are not suited to crops. They are used for range. In some areas the water table is within the depths of tree roots. Dryland capability unit Vw–2; Bottomland range site.

Frio Series

The Frio series consists of deep, well-drained soils on bottom land. These soils formed in calcareous alluvial sediments. Slopes are nearly level to gently sloping, and surfaces are plane to weakly concave.

Figure 9.—Peanuts on Demona loamy sand, 0 to 3 percent slopes.

In a representative profile the surface layer is very dark grayish-brown clay loam about 20 inches thick. The next layer is dark grayish-brown silty clay loam about 16 inches thick. The underlying material is brown silty clay loam stratified with gravel.

Permeability and internal drainage are moderately slow. Runoff is slow. The available water capacity is high.

About half the acreage of Frio soils is cultivated. The rest is used for range.

Representative profile of Frio clay loam 50 yards north of pavement, one-fourth mile east from the northeast corner of the square in Brady, on the flood plain of Brady Creek:

A11—0 to 20 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky and granular structure; hard, firm; many roots; porous peds; few earthworm channels; few lime specks; few limestone pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

A12—20 to 36 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, firm; common roots; porous peds; few earthworm channels and casts; common lime specks; few limestone pebbles as much as one-half inch in diameter; few thin stratifications of heavy silt loam in the lower 6 inches; uneven staining of organic matter; calcareous; moderately alkaline; clear, smooth boundary.

C—36 to 60 inches, brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; massive; hard, firm; upper 4-inch layer is about 15 to 20 percent subrounded limestone gravel mostly ¼ to 1½ inches in diameter and a few 3 to 6 inches long and 2 to 3 inches thick; many lime threads and films; few subrounded limestone pebbles up to 1 inch in diameter; common lime specks; few thin strata of silt loam; few faint bedding planes; few fragments of snail shells; calcareous; moderately alkaline.

The A horizon ranges from 20 to 42 inches in thickness and from dark brown to very dark grayish brown. The C horizon ranges from brown to light yellowish brown. Depth to waterworn gravel ranges from 3 to more than 5 feet. The content of coarse fragments of limestone and chert pebbles ranges from 5 to 35 percent.

Frio clay loam (Fo).—This soil is in oblong areas oriented with the streamflow. Areas are 15 to 300 acres in size and 200 feet to about a mile wide. Slopes are dominantly about 0.5 percent but range from 0 to 1 percent. Floodwaters are slow moving and remain for a short time. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Dev, Karnes, and Nuvalde soils and a soil similar to this Frio soil, but underlain by gravel or limestone at a depth

of less than 6 feet. Also included are stream channels, streambanks, and scour channels that are too small to be shown on the scale of map used. Karnes and Nuvalde soils are at slightly higher elevations than this Frio soil. Dev soils are near streambanks and along flooded areas. The soil similar to this Frio soil, but not so deep, is on the flood plain of small drainageways and streams above the main stream. Slopes along scour channels and streambanks are more than 1 percent. These inclusions make up less than 15 percent of the total acreage of this Frio soil and are 5 acres or less in size.

Most of the acreage of this Frio soil is cultivated. Trees are confined to streambanks and old channel fill areas. Flooding generally occurs at intervals of 15 to 30 years. Dryland capability unit IIc–4; irrigated capability unit I–4; Bottomland range site.

Frio clay loam, channeled (Fr).—This soil is on the flood plain of upland drainageways. Areas are elongated, 20 to several hundred acres in size, and 100 to 300 yards wide. Surfaces are complex. Slopes range from 0 to 3 percent but are dominantly 0.5 to 1.5 percent. The surface layer of this soil is dark-brown clay loam about 20 inches thick. The next layer is dark grayish-brown silty clay loam about 22 inches thick and is stratified. The underlying material is brown, stratified silty clay loam.

Included with this soil in mapping are areas of Dev soils, Frio clay loam, and a soil similar to this Frio soil, but less clayey. Dev soils and the less clayey soil similar to this Frio soil are adjacent to the channel, in strips a few yards wide and 1 to 10 acres in size. Frio clay loam occurs as irregular areas 1 to 5 acres in size and slightly above the more frequently flooded areas.

This Frio soil is subject to frequent damaging overflow from swiftly moving waters that cause scouring and deposition. Flooding occurs once or twice a year. The channel meanders from one upland bank to the other, frequently cutting the flood plain into areas 1 to 10 acres in size. Arable spots on the flood plain are too small to cultivate or are inaccessible to farm machinery. Limestone cobblestones and flags are in much of the channel and in places extend across the flood plain where the channel makes sharp bends.

This Frio soil is used for range. Trees grow near the banks of streams and in old channel fill areas in a few of the larger drainageways. Dryland capability unit Vw–1; Bottomland range site.

Karnes Series

The Karnes series consists of well-drained, moderately deep to deep soils that formed in limy material. These soils border drainageways, are on the sides of stream terraces, and are on foot slopes below limestone hills. Surfaces are plane to complex, and slopes range from 1 to 5 percent.

In a representative profile the surface layer is light brownish-gray loam about 14 inches thick. The next layer is pale-brown loam that extends to a depth of 38 inches. The underlying material is very pale brown loam that contains films and threads of lime.

Permeability is moderately rapid. Runoff is slow to medium. The available water capacity is high.

Most of the acreage of this Karnes soil is cultivated along with large areas of other soils. A few acres are in native range.

Representative profile of Karnes loam, 1 to 5 percent slopes, 12.6 miles south and 30 degrees west of the courthouse in Brady, 1,000 feet south of Farm Road 2028, 1.1 miles south of the courthouse on U.S. Highway No. 87, then 12 miles west on Farm Road 2028:

A1—0 to 14 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, very fine, subangular blocky and granular structure; hard, friable; porous peds; few films and threads of lime in lower part; few worm casts; few angular and subrounded limestone fragments ½ inch to 2 inches in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B2—14 to 38 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate, fine and very fine, subangular blocky structure; hard, friable; few fine roots; porous peds; common films and threads of calcium carbonate; few worm casts; few limestone fragments 2 to 10 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—38 to 62 inches, very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; hard, friable; common fine and medium pores; common films and threads of lime; few concretions and soft masses of white lime; few limestone pebbles with thin coating of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 34 to 48 inches in thickness.

The A horizon ranges from 10 to 22 inches in thickness and from brown or light brownish gray to very pale brown. The B horizon ranges from 20 to 26 inches in thickness and from pale brown or very pale brown to light yellowish brown. It is 18 to 35 percent clay. The Cca horizon is weakly expressed and is absent in some profiles. It ranges from loam to silty clay loam and from very pale brown to light yellowish brown. The content of calcium carbonate in the lower part of the A horizon and B horizon is more than 40 percent.

Karnes loam, 1 to 5 percent slopes (KaC).—This soil occurs as oblong bands 10 to 100 acres in size. Slopes are dominantly 2.5 to 3.5 percent.

Included with this soil in mapping are areas of Brackett, Nuvalde, Rowena, Tobosa, and Valera soils. Brackett soils occur as bands or rounded knobs at the higher elevations. The rest are in natural drainageways. These inclusions are 1 to 5 acres in size and make up as much as 15 percent of the total acreage of this Karnes soil.

About 75 percent of the acreage is cultivated because this soil is adjacent to more productive soils. It is not well suited to cultivation, however, because the excessive lime content causes nutrient unbalance in some plants. Dryland capability unit IIIe–5; Deep Upland range site.

Karnes Series, Moderately Shallow Variant

The Karnes moderately shallow variant consists of well-drained, moderately deep soils that formed in sandstone and limy material. These soils are on foot slopes at the base of limestone hills and on side slopes along drainageways. Slopes are mainly convex and range from 1 to 5 percent.

In a representative profile the surface layer is yellowish-brown loam about 5 inches thick. The next layer is

light yellowish-brown loam about 13 inches thick. Below this is very pale brown loam about 12 inches thick. The underlying material is light-gray, weakly cemented sandstone.

Permeability is moderately rapid, and runoff is slow to medium. The available water capacity is low.

Most areas of this soil are used for range. A few are used for crops.

Representative profile of Karnes loam, moderately shallow variant, 1 to 5 percent slopes, 10.3 miles north and 23 degrees east of the courthouse in Brady, or 23 yards south of field fence, 10.5 miles north of the courthouse in Brady on U.S. Highway No. 377, and 550 yards west along field fence:

Ap—0 to 5 inches, yellowish-brown (10YR 5/5) loam, dark yellowish brown (10YR 4/4) moist; weak, fine, granular structure; hard, friable; few small concretions of calcium carbonate; few caliche fragments on surface; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—5 to 18 inches, light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate, very fine subangular blocky structure; hard, friable; common films and threads of lime; few calcium carbonate concretions 3 to 5 millimeters in diameter; few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—18 to 30 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; weak, fine, subangular blocky structure; hard, friable; 10 to 15 percent concretions and soft masses of lime up to 2 inches in diameter; estimated calcium carbonate equivalent more than 40 percent; calcareous; moderately alkaline; clear, wavy boundary.

C—30 to 60 inches, light-gray (10YR 7/2), weakly cemented, fine-grain sandstone; thin lime coatings in upper part and in partings.

The solum ranges from 20 to 40 inches in thickness. Visible calcium carbonate in the form of concretions and soft masses makes up 10 to 30 percent of the soil mass, and the calcium carbonate equivalent is estimated to exceed 40 percent. More than a third of the clay fraction in the B horizon is estimated to be carbonate. The A and B horizons are loam to clay loam and 18 to about 25 percent clay.

The A horizon ranges from pale brown or yellowish brown to brown and is 5 to 8 inches thick. The B2 horizon ranges from pale brown or light yellowish brown to light reddish brown and is 9 to 20 inches thick. The B3ca horizon ranges from very pale brown to reddish yellow and is 6 to 12 inches thick. The C layer typically is weakly cemented, light-gray sandstone.

Karnes loam, moderately shallow variant, 1 to 5 percent slopes (KeC).—This soil is on low, weakly convex ridges. Areas are oval to irregular in shape and range from 10 to 60 acres in size. Slopes are complex and dominantly 1.5 to 3 percent.

Included with this soil in mapping are small areas of Brackett, Mereta, Nuvalde, and Rowena soils. These inclusions are 1 to 5 acres in size. Brackett soils occupy positions similar to those of Karnes soils. The rest are at lower levels near the outer edge of mapped areas. Also included are a few areas where slopes are short and more than 5 percent.

This Karnes soil is better suited to range than to other uses. Most previously cultivated acreages of this soil have been returned to range. Areas of 1 to about 5 acres in fields with other soils are cultivated. Dryland capability unit IVe–1; Adobe range site.

Katemcy Series

The Katemcy series consists of moderately deep, well-drained, undulating soils on uplands. These soils formed in loamy and clayey material weathered from tilted schist. They are in shallow valleys 0.25 to 0.5 mile wide and 0.5 to 1.5 miles long. The numerous lateral drains in these soils lead to a single drainageway. Slopes are 2 to 8 percent.

In a representative profile the surface layer is reddish-brown loam about 8 inches thick. The next layer, to a depth of 35 inches, is clay that is red in the upper part and dark red in the lower part. The underlying material is light brownish-gray weathered schist.

Permeability and internal drainage are slow. Runoff is medium. The available water capacity is high.

Most areas of these soils are used for range. A few are used for crops.

Representative profile of Katemcy loam in an area of Katemcy-Ligon association, undulating, 16.2 miles south and 41 degrees east of the courthouse in Brady, 150 yards south of pasture fence, 4.1 miles south of Voca on Ranch Road 1851 to pasture gate and 1.5 miles east to ranchhouse, then east-northeast 550 yards:

A1—0 to 8 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate, very fine, subangular blocky structure; hard, friable; many roots; common fine pores; few worm casts; few angular and subrounded quartz pebbles on the surface and in the soil; slightly acid; clear, smooth boundary.

B21t—8 to 22 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium and coarse, angular blocky structure; very hard, very firm; many roots; few thin clay films on peds; common quartz pebbles in lower 4 inches; slightly acid; clear, smooth boundary.

B22t—22 to 35 inches, dark-red (2.5YR 3/6) clay, dark red (2.5YR 3/6) moist; moderate, fine and medium, angular blocky structure; very hard, very firm; few fine roots; few fine pores; continuous clay films on ped faces; 5 to 10 percent partly weathered, soft schist fragments, 2 to 10 millimeters in size, in lower 5 inches; mildly alkaline; clear, wavy boundary.

C—35 to 48 inches, light brownish-gray (10YR 6/2) schist, olive gray (5Y 5/2) moist; laminated, weakly cemented to strongly cemented, weathered schist, partly weathered along cleavage planes; tilted at about 60 degrees from horizontal.

The solum ranges from 22 to 40 inches in thickness. Reaction is slightly acid or neutral in the A horizon and upper part of the Bt horizon. Very fine mica flakes range from few to common throughout most profiles. The amount of quartz gravel ranges from a few pebbles to about 15 percent of the surface area and the soil mass.

The A horizon ranges from 5 to 9 inches in thickness, from loam to clay loam, and from brown to reddish brown. The B horizon ranges from 15 to 33 inches in thickness, is clay or clay loam, and ranges from dark red or reddish brown to red. The lower 5 inches of the B horizon is 5 to 10 percent partly weathered, soft schist fragments. The C horizon is laminated, weakly cemented to indurated schist and schistose gneiss that tilts from 10 to 60 degrees. Its color ranges from shades of brown through gray, olive, yellow, green, and red.

Katemcy-Ligon association, undulating (KlC).—This mapping unit is in broad areas several hundred to more than 1,000 acres in size. It is about 40 percent Katemcy loam, 30 percent Ligon loam, and 30 percent Acove, Cobb, Demona, Pedernales, and Voca soils, a very shallow

fine sandy loam soil overlying schist, outcrops of schistose and gneiss, and quartz dikes. Each delineation on the map contains both Katmecy and Ligon soils, but the percentage of each soil varies. Areas are 29 to 54 percent Katmecy soil and 20 to 39 percent Ligon soil.

The Katemcy soil is in shallow valleys between ridges of the Ligon soil. Surfaces are plane to concave, and slopes are 2 to 8 percent.

The Ligon soil is on oval-shaped tops of ridges that are interconnected by weak saddles. Surfaces are convex, are plane to complex, and slopes are 1 to 5 percent.

The Cobb, Demona, Pedernales, and Voca soils are in low-lying areas near the outer edge of mapped areas. The Acove soil is gently sloping and is on low ridges bordering mapped areas. The very shallow soil overlying schist is strongly sloping and mostly occurs as bands bordering natural drainageways, and to a limited extent as bands on narrow ridges along the up side of fault zones. The quartz dikes are common in Ligon soils. They are oblong in shape and about ¼ acre to 2 acres in size. These dikes are on and parallel with the crests of ridges and are also below slope breaks at the terminal areas of ridges. Out crops of schist and schistose gneiss occur as bands a few feet to 50 feet wide and several hundred yards long and are oriented south-southwest to north-northeast. The distance between outcrops varies between a few yards to more than one-half mile. The outcrops are on the tops and side of ridges. The wider bands, which contain mostly cobblestones and boulders, are toward the outer perimeter of the mapped areas, along the up side of fault zones.

Most of the acreage is used for range. A few acres are farmed. Dryland capability unit VIe–1; Schist range site.

Kavett Series

The Kavett series consists of nearly level to gently sloping, shallow, well-drained soils on uplands. These soils formed in calcareous clayey material weathered from strongly cemented caliche and limestone. They are on limestone plateaus and in shallow valleys. Surfaces are plane to complex, and slopes are 1 to 5 percent

In a representative profile the surface layer is dark grayish-brown silty clay about 8 inches thick (fig. 10). The next layer is brown silty clay about 8 inches thick. The underlying material, to a depth of 30 inches, is indurated caliche. Below this is limestone.

Internal drainage and permeability are moderately slow. Runoff is slow. The available water capacity is low.

Most of the acreage of Kavett soils is in range. A small acreage is cultivated.

Representative profile of Kavett silty clay, 1 to 3 percent slopes, 13.5 miles south, 73 degrees west of the courthouse in Brady, or 14 miles west on Farm Road 2028 from its intersection with U.S. Highway No. 87 in Brady, then 3 miles south and 0.5 mile west on county road to gate, then 0.8 mile southwest in pasture, 0.5 mile southwest of the principal spillway of waterflow-retarding structure:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine and very fine, subangular blocky structure; hard, firm; many roots; about 5 percent hard rounded and angular limestone fragments ¼ inch to 1½ inches across long axis; calcareous; moderately alkaline; clear, wavy boundary.

A12—8 to 16 inches, brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate, fine and very fine, subangular blocky structure; hard, firm; about 5 percent limestone fragments up to 2 inches across long axis; common roots; about 10 percent limestone fragments ½ to 1 inch across in lower 2 inches; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—16 to 20 inches, indurated platy caliche; silty clay in cracks makes up less than 5 percent of mass; calcareous; moderately alkaline; abrupt, wavy boundary.

R—20 to 30 inches, strongly cemented limestone; 35 percent or more hard nodular limestone the size of gravel and cobblestones; grades to a thick bed of hard angular and subrounded limestone cobblestones and layered limestone that has coatings of caliche and soft lime.

The solum ranges from 10 to 20 inches in thickness, from clay loam to clay, and from brown to dark grayish brown. The Ccam horizon is 2 to 4 inches thick. The R layer is strongly cemented limestone of varying hardness.

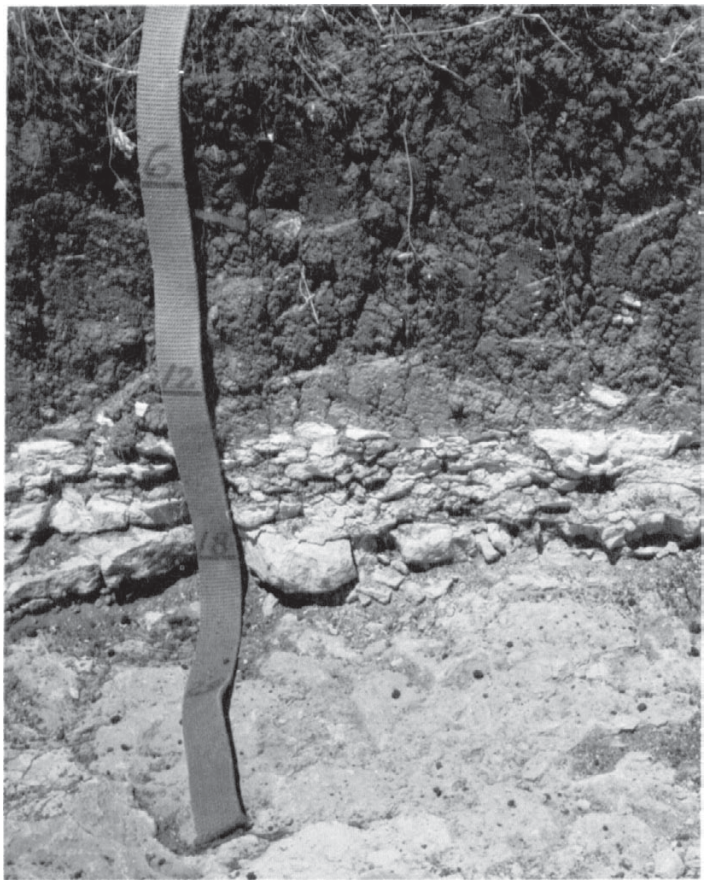

Figure 10.—Profile of Kavett silty clay, 1 to 3 percent slopes.

Kavett silty clay, 1 to 3 percent slopes (KtB).—This soil is on uplands. Areas are oblong, oval, or irregular in shape and are 30 to 200 acres in size. Surfaces are complex and slopes are as much as 3 percent in shallow valleys. Surfaces are plane and slopes are 1 to 1.5 percent on plateaus.

Included with this soil in mapping are areas of Brackett, Speck, Tarrant, Tobosa, and Valera soils.

Tarrant soils are on ridges and knolls and occur as bands at elevations above Kavett soils. Tobosa and Valera soils are in natural drainageways or slight depressions. Brackett soils occur as oblong to round areas on low ridges and knobs and have short steep slopes. Speck soils are nearly level to gently sloping and are at the higher elevations. These inclusions are 1 to 5 acres in size.

About 25 percent of the acreage of this Kavett soil is cultivated, and the rest is in range. Dryland capability unit IIIe–6; Shallow range site.

Krum Series

The Krum series consists of gently sloping, deep, well-drained soils in valleys near the base of steep scarps. These soils formed in alluvium from receding scarps and valley fill alluvium. Surfaces are plane to weakly concave, and slopes are 1 to 3 percent.

In a representative profile the soil is silty clay to a depth of about 70 inches. The surface layer is about 24 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The next layer is brown and about 20 inches thick. The underlying material is strong brown in the upper part and brown in the lower part.

Permeability is moderately slow. Runoff is medium. The available water capacity is high.

Most areas of Krum soils are in range. Some are used for crops.

Representative profile of Krum silty clay, 1 to 3 percent slopes, 15.4 miles north and 44 degrees east of the courthouse in Brady, one-half mile west of pavement, 3 miles east of Rochelle on U.S. Highway No. 190, then 4.4 miles north on Farm Road 2822:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, subangular blocky structure; hard, firm; half-inch light yellowish-brown (10YR 6/4) loam surface crust; many roots; few earthworm casts; calcareous; moderately alkaline; clear, smooth boundary.

A12—8 to 24 inches, brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate, very fine and fine, subangular and angular blocky structure; hard, firm; common roots; few earthworm casts; common pores; calcareous; moderately alkaline; gradual, smooth boundary.

B2—24 to 42 inches, brown (7.5YR 4/4) silty clay, dark brown (7.5YR 3/4) moist; moderate, medium, angular blocky structure parting to very fine angular blocky structure; very hard, very firm; porous peds; few ferromanganese concretions; common pressure faces; dark soil from the A12 horizon is in partly sealed cracks; few earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—42 to 60 inches, strong-brown (7.5YR 5/6) silty clay, strong brown (7.5YR 4/6) moist; massive; very hard, firm; about 5 percent of horizon is calcium carbonate concretions ⅛ to ½ inch in diameter; common films and threads of lime; few, lime-coated, hard limestone fragments; few ferromanganese concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C2—60 to 70 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; massive; very hard, firm; common films and threads of lime; few calcium carbonate concretions 2 to 5 millimeters in diameter; calcareous; moderately alkaline.

The solum ranges from 38 to 52 inches in thickness. Cracks 1 to 3 centimeters wide extend to depths of more than 20 inches when the soil is dry.

The A horizon ranges from 20 to 34 inches in thickness and from dark brown to dark grayish brown. The B horizon ranges from 6 to 28 inches in thickness and from brown to yellowish brown. The Cca horizon ranges from clay loam to silty clay and from brown or strong brown to light olive brown. Calcium carbonate concretions and soft masses in this horizon range from a few to as much as 10 percent of the soil mass.

Krum silty clay, 1 to 3 percent slopes (KuB).—This soil is in areas between valley floors and steep receding scarps. Areas are oblong to irregular in shape and are 50 to 100 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 1.5 to 2.5 percent.

Included with this soil in mapping are areas of Owens and Tobosa soils and colluvial deposits of stratified, gravelly, calcareous materials. Tobosa clay is in areas oblong to oval in shape and 1 to 5 acres in size along or near natural drainageways. Owens clay is in areas 2 to 5 acres in size on low rounded knobs and ridges. Colluvial material is along the upper margins of Krum soils and occurs as irregularly shaped areas, 2 to 10 acres in size, that have slightly raised ridges and alluvial fans extending downslope. A few areas in the upper part of this mapping unit have a deposit of pale-brown overwash, 1 to 10 inches thick, that ranges from clay loam to fine sandy loam. Most areas of this soil have a few shallow gullies that are crossable with farm machinery.

About 60 percent of the acreage is in range. The rest is used for crops. Dryland capability unit IIIe–3; irrigated capability unit IIe–4; Deep Upland range site.

Latom Series

The Latom series consists of moderately well drained, shallow to very shallow soils that formed in loamy materials weathered from thin-bedded calcareous sandstone. These soils are on steep scarps, 30 to 80 feet high, 150 to 400 yards wide, and several miles long. Slopes are simple and range from 6 to 30 percent. Coarse fragments of sandstone and limestone cover about 30 to 85 percent of the surface area.

In a representative profile the surface layer is brown, calcareous fine sandy loam about 6 inches thick. Below this is cemented sandstone that has thin coatings of lime.

Permeability and runoff are slow. The available water capacity is low.

Latom soils are nonarable and are used for range.

Representative profile of Latom fine sandy loam in an area of Latom soils, steep, 10.7 miles south and 22 degrees east of the courthouse in Brady, 75 feet west of pasture fence, 0.4 mile south of the junction of U.S. Highway No. 377 and Farm Road 1955, in Camp San Saba:

A1—0 to 6 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak, very fine, subangular blocky structure; hard, friable; about 5 to 10 percent platy sandstone fragments ¼ to ¾ inch thick and up to 3 inches across; about 30 to 40 percent surface covering of hard limestone fragments and a few, small, angular cobblestones; calcareous; moderately alkaline; abrupt, smooth boundary.

C—6 to 20 inches, very pale brown (10YR 7/3), cemented, calcareous sandstone that can be cut with a spade; thin beddings of about 10 percent fine sandy loam in

interstices; thin calcium carbonate coating on underside of sandstone.

The solum ranges from 4 to 14 inches in thickness. The A horizon ranges from fine sandy loam to loam and is about 15 percent clay. It ranges from light yellowish brown to brown. In a few profiles transitional layers up to 16 inches thick are between the A horizon and C horizon. These layers are 20 to 40 percent loamy calcareous earth. The C horizon is very pale brown to olive, thin-bedded, fractured sandstone. Layered sandstone is ¼ inch to 3 inches thick. Lime coatings and nodular concretions of lime have accumulated in the upper part of the C horizon.

The Latom soils in McCulloch County are outside the defined range of the Latom series in that they are underlain by sandstone that can be cut with a spade. This difference does not alter use and management.

Latom soils, steep (LAE).—These soils occur as elongated bands 50 to about 150 acres in size. Slopes are dominantly about 20 percent but range from 6 to 30 percent. From 5 to 20 percent of the surface area typically has a covering of platy sandstone fragments. Hard limestone fragments and cobblestones, from downward creep of receding limestone ledges, cover about 25 to 65 percent of the surface along upper levels.

Areas of Brackett and Tarrant soils and a calcareous clayey soil that formed in outcrops of geological clays and shales make up less than 10 percent of the total acreage. These areas are 1 to 10 acres in size. Tarrant soils form a cap above the Latom soils. Brackett soils and the clayey soil are on the lower third of the scarp.

This Latom soil is used for range. Inaccessibility limits its use for cattle. Dryland capability unit VIIs–2; Stony Loam range site.

Ligon Series

The Ligon series consists of shallow, well-drained soils that formed in loamy materials weathered from tilted schist. These soils are on low, oval ridges interconnected by weak saddles on upland prairies in an undulating landscape above Katemcy soils, which are in shallow valleys. Slopes are dominantly 1 to 3 percent but range up to 5 percent.

In a representative profile the surface layer is reddish-brown loam about 5 inches thick. The next layer, about 11 inches thick, is dark-red clay loam that is about 5 percent quartz pebbles and schist fragments. The underlying material is schist.

Permeability is moderately slow. Runoff and internal drainage are medium. The available water capacity is low.

Ligon soils are nonarable and are used for range.

The Ligon soils in McCulloch County are mapped only with Katemcy soils.

Representative profile of Ligon loam in an area of Katemcy-Ligon association, undulating, 16 miles south and 58 degrees east of the courthouse in Brady, or 670 yards east-northeast of ranchhouse, 4.1 miles south of Voca on Ranch Road 1851 to pasture gate, then 1.5 miles east along private road:

A1—0 to 5 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate, very fine, subangular blocky structure; hard, friable; common roots; about 10 percent angular and subrounded quartz gravel, mostly ½ to ¾ inch in diameter and a few to 3 inches along long axis; about 5 to 30 percent surface covering of quartz gravel; surface crust breaks easily; neutral; clear, smooth boundary.

B2t—5 to 16 inches, dark-red (2.5YR 3/6) clay loam, dark red (2.5YR 3/6) moist; moderate, medium, blocky structure; very hard, firm; thin nearly continuous clay films on peds; about 5 percent angular and subrounded quartz fragments 2 to 15 millimeters in diameter; few schist fragments ½ inch thick and up to 1 inch long in lower 2 inches; neutral; clear, wavy boundary.

C—16 to 30 inches, light-brown (7.5YR 6/4), grayish-brown (2.5Y 5/2), and light olive-gray (5Y 6/2) schist that is fine grained, laminated, weakly to strongly cemented, and tilts at an angle of about 60 degrees; red soil fines along cleavage planes and in small pockets in upper 3 to 5 inches.

The solum ranges from 12 to 20 inches in thickness and from less than 5 percent to about 20 percent coarse fragments, mostly quartz. Reaction is neutral to mildly alkaline.

The A horizon ranges from 4 to 7 inches in thickness, from reddish brown to brown, and from fine sandy loam to clay loam. The Bt horizon ranges from 8 to 11 inches in thickness and from dark red or reddish brown to red. It is 30 to 35 percent clay. The lower 5 inches of the Bt horizon is about 5 to 10 percent platy schist fragments. The C horizon is mainly hornblende schist and some schistose gneiss, which tilts at an angle of 30 to about 60 degrees from horizontal.

Mereta Series

The Mereta series consists of shallow, well-drained soils that formed in old alluvium. Slopes are 0 to 5 percent.

In a representative profile the surface layer is clay loam. The upper 5 inches is dark grayish brown. The next 14 inches is dark brown clay loam. The underlying material is 4 inches of strongly cemented caliche overlying soft pink caliche that is 50 percent or more lime and extends to a depth of about 40 inches. Below this, to a depth of about 80 inches, is light-brown clay loam.

Internal drainage is good. Permeability is moderately slow, except in the horizon of cemented caliche (fig. 11) where it is slow to very slow. Runoff is slow. The available water capacity is low.

Mereta soils are used mostly for cultivated crops. Part of the acreage is range.

Representative profile of Mereta clay loam, 1 to 3 percent slopes, in a cultivated field 150 yards north of U.S. Highway No. 190, 1.5 miles southwest on U.S. Highway No. 190 from center of Rochelle:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, friable; few fine caliche fragments; few roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—5 to 11 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine, subangular blocky structure; hard, friable, few roots; calcareous; moderately alkaline; gradual, smooth boundary.

A12—11 to 19 inches, dark-brown (7.5YR 4/4) clay loam that is slightly more clayey than that in the A11 horizon, dark brown (7.5YR 3/4) moist; moderate, fine, subangular blocky structure; hard, firm peds, but mass is crumbly; few caliche fragments in lower part; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—19 to 23 inches, pinkish-white (7.5YR 8/2) caliche; strongly cemented and platy; 1 percent or less of fine earth between plates and in solution channels; clear, wavy boundary.

Figure 11.—**Profile of Mereta clay loam, 0 to 1 percent slopes. Upper arrow marks division between A11 and A12 horizons. Lower arrow points to horizon of cemented caliche.**

C2ca—23 to 40 inches, pink (7.5YR 8/4) limy earth of about loam texture, light brown (7.5YR 6/4) moist; massive; soft, friable; 50 percent or more fine disseminated particles, soft lumps, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C3ca—40 to 80 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; friable and crumbly; 15 to 20 percent soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 14 to 20 inches in thickness.

The Ap horizon ranges from 4 to 7 inches in thickness and from brown to dark grayish brown. The A11 and A12 horizons range from brown or dark brown to reddish brown. The A11 horizon ranges from 4 to 10 inches in thickness, and the A12 horizon ranges from 6 to 10 inches in thickness. The C1cam horizon ranges from 3 to 8 inches in thickness and from strongly cemented to indurated. Below the C1cam horizon is reddish-yellow to pink and very pale brown, limy earth of loam to clay loam texture.

Mereta clay loam, 0 to 1 percent slopes (MeA).—This soil is on plains. Areas are oblong to irregular in shape and are 30 to 400 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly near 0.5 percent. The surface layer is about 5 inches of dark grayish brown clay loam. The next layer is dark-brown clay loam about 15 inches thick. The underlying material is strongly cemented caliche.

Included with this soil in mapping are areas of Cho, Kavett, Nuvalde, Rowena, Salga, and Tobosa soils. These inclusions are up to 5 acres in size and make up less than about 10 percent of the total acreage. Rowena, Salga, and Tobosa soils are in slight depressions. Cho and Nuvalde soils are slightly above this Mereta soil. Kavett soils are in higher areas near limestone outcrop.

Most areas of this Mereta soil are cultivated. Dryland capability unit IIIs–1; Shallow range site.

Mereta clay loam, 1 to 3 percent slopes (MeB).—This soil is on plains. Areas are oblong to irregular in shape and are 30 to 350 acres in size. Surfaces are simple to complex, and slopes are dominantly 1.5 to 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of soils where sheet erosion is moderate and a few weakly parabolic gullies have formed but are crossable with farm machinery. Also included are areas of Cho, Kavett, Karnes, Nuvalde, and Rowena soils, 1 to 5 acres in size, that make up less than 10 percent of the total acreage. Nuvalde and Rowena soils are in natural drainageways and along the lower slopes of the mapping unit. Karnes soils are in oblong to oval patterns on side slopes and low rises. Kavett and Cho are at the higher elevations.

About 80 percent of the acreage of this Mereta soil is cultivated (fig. 12). Dryland capability unit IIIe–7; Shallow range site.

Miles Series

The Miles series consists of deep, well-drained soils that formed in old alluvium. Slopes are 1 to 3 percent.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The next 10 inches is dark-red sandy clay loam. The next layer is sandy clay loam about 36 inches thick. It is red in the upper part and reddish yellow in the lower part. Below this is clay loam that is reddish yellow in the upper part and pink in the lower part.

Permeability is moderate. Runoff is slow to medium. The available water capacity is high.

Most areas of Miles soils are cultivated. A few are used for range.

Representative profile of Miles fine sandy loam, 1 to 3 percent slopes, 21 miles north, 15 degrees west of the courthouse in Brady, in a cultivated field 250 yards west of county road, 2.9 miles west of the junction of U.S. Highway No. 283 and Farm Road 765, then 2.25 miles north on county road:

Ap—0 to 8 inches, brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak, fine, granular structure; hard, friable; common roots; few pores; few earthworm channels; continuous surface crust; few rounded quartz fragments; mildly alkaline; clear, smooth boundary.

B21t—8 to 18 inches, dark-red (2.5YR 3/6) sandy clay loam, dark red (2.5YR 3/6) moist; coarse prismatic structure parting to moderate, coarse, blocky structure; very hard, firm; few clay films on ped faces; porous peds; few earthworm channels; mildly alkaline; clear, smooth boundary.

B22t—18 to 30 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; coarse prismatic structure parting to moderate, medium and coarse, blocky structure; very hard, firm; porous peds; few thin

Figure 12.—**Bundled hegari in shocks. The soil is Mereta clay loam, 1 to 3 percent slopes.**

clay films on ped faces; few earthworm channels and casts; mildly alkaline; clear, smooth boundary.

B23t—30 to 54 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; coarse prismatic structure parting to weak, medium, blocky structure; very hard, friable; few films and threads of calcium carbonate in lower part; calcareous in lower 12 inches; moderately alkaline; clear, smooth boundary.

B24tca—54 to 68 inches, reddish-yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak, medium and fine, subangular blocky structure; hard, friable; few clean sand grains; about 10 to 15 percent calcium carbonate concretions and soft lumps of lime 5 to 15 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—68 to 80 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; weak, medium, subangular blocky structure; hard, friable; about 5 percent soft lime and calcium carbonate concretions 1 to 5 millimeters in diameter; the powdery calcium carbonate coats the peds; calcareous; moderately alkaline.

Depth to the secondary lime accumulation ranges from 36 to more than 70 inches.

The A horizon ranges from 5 to 11 inches in thickness and from reddish brown to brown. The B21t horizon ranges from 10 to 24 inches in thickness, from brown to dark red or red, and from loam to sandy clay loam. The B22t horizon ranges from 6 to 25 inches in thickness, from clay loam to sandy clay loam, and from yellowish red to red. The B23t horizon ranges from 12 to 24 inches in thickness, from reddish yellow to red, and from clay loam to sandy clay loam. The B24tca horizon ranges from 8 to 15 inches in thickness, from loam to clay loam, and from yellowish red or reddish yellow to pink. It is 10 to 15 percent concretions and soft masses of lime. The B3ca horizon ranges from prominent to indistinct, from clay loam to fine sandy loam, and from pink to reddish yellow.

Miles fine sandy loam, 1 to 3 percent slopes (MfB).—This soil is in oblong to irregularly shaped areas 30 to 400 acres in size. Surfaces are plane to complex, and slopes are dominantly 1.5 to 2 percent.

Included with this soil in mapping are areas of Pedernales, Rochelle, and Sagerton soils; a shallow, calcareous loam overlying gravelly caliche; and a few areas where slopes are less than 1 percent. Pedernales and Sagerton soils are nearly level to gently sloping and are in areas a few feet lower on the landscape than Miles soils. Rochelle soils are on low ridges and rounded knobs slightly above Miles soils. The shallow, calcareous loam is on low rounded knobs slightly higher than the surrounding Miles soils. These inclusions are 1 to 5 acres in size and make up less than 15 percent of the total acreage. A few areas, 1 to 5 acres in size, of Miles soils have gravel beds at a depth of 30 to 60 inches.

About 85 percent of the acreage of this Miles soil is cultivated. Dryland capability unit IIe–1; irrigated capability unit IIe–1; Sandy Loam range site.

Miller Series

The Miller series consists of deep, moderately well drained soils that formed in calcareous, clayey sediments. These soils are on flood plains of rivers and creeks. Slopes are 0 to 1 percent. Flooding occurs at about 30-year intervals.

In a representative profile the surface layer is reddish-brown silty clay about 14 inches thick. The next layer is reddish-brown silty clay about 22 inches thick. Below this is yellowish-red silty clay that has a slight lime accumulation.

Permeability is very slow. Runoff and internal drainage are slow. The available water capacity is high.

Most areas of these soils are cultivated. A few are in native range.

Representative profile of Miller silty clay, 25.4 miles north and 33 degrees east of the courthouse in Brady, in a pasture 650 yards north of a county road, 0.7 mile east of the intersection of two county roads at Milburn:

A1—0 to 14 inches, reddish-brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate, very fine, subangular and angular blocky structure; hard, firm but crumbly; common roots; upper 2 inches is a soft mass of discrete, very fine, subangular blocky peds; ⅛-inch surface crust on overgrazed pasture; calcareous; moderately alkaline; gradual, wavy boundary.

B2—14 to 36 inches, reddish-brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, blocky structure; very hard, firm; common pressure faces that do not intersect; cracks more than 1 centimeter wide below a depth of 20 inches; roots pass through peds; few calcium carbonate concretions 2 to 5 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C—36 to 60 inches, yellowish-red (5YR 4/6) silty clay, yellowish red (5YR 3/6) moist; massive; very hard, firm; few fine roots; few pores; weak pressure faces; common films and threads of calcium carbonate 1 to 2 millimeters in diameter; calcareous; moderately alkaline.

The solum ranges from 30 to 70 inches in thickness.

The A horizon ranges from 10 to 30 inches in thickness and from reddish brown to dark brown. The B horizon ranges from 20 to 28 inches in thickness and from reddish brown to dark brown. It is mainly silty clay but ranges to clay and silty clay loam. The clay content of this horizon ranges from 35 to about 60 percent. The C horizon ranges from reddish brown to yellowish brown to yellowish red. The lime content of this horizon ranges from films and threads to about 1 percent calcium carbonate concretions and small lumps of lime.

Miller silty clay (Mr).—This soil is in oblong to long and narrow areas 20 to about 100 acres in size. Surfaces are plane to weakly concave. Slopes are 0 to 1 percent but are dominantly 0.2 to 0.5 percent. This soil receives sediments from slow-moving water during occasional flooding.

Included with this soil in mapping are areas of Clairemont and Yahola soils. These contrasting soils are in oblong to irregular areas that are a few feet higher on the landscape than Miller soils. Also included are overdeposits of light loamy sediments of upland origin along some natural drainageways. A few, short, choppy slopes are along drainageways dissecting this soil. These inclusions make up as much as 5 percent of some mapped areas and are 1 to 5 acres in size.

About 75 percent of the acreage of this Miller soil is cultivated. Dryland capability unit IIs–1; irrigated capability unit IIs–1; Bottomland range site.

Nuvalde Series

The Nuvalde series consists of well-drained soils on uplands. These soils formed in calcareous old alluvium sediments. They are moderately deep over caliche. Surfaces are plane to complex, and slopes are 1 to 5 percent.

In a representative profile the surface layer is dark grayish-brown clay loam about 13 inches thick (fig. 13). The next layer is clay loam about 19 inches thick. It is brown in the upper part and light brown in the lower part. Below this is pink clay loam that has a high content of lime.

Figure 13.—**Profile of Nuvalde clay loam, 1 to 3 percent slopes.**

Permeability is moderate. Runoff is slow. The available water capacity is high.

Most areas of Nuvalde soils are cultivated. Some are used for range.

Representative profile of Nuvalde clay loam, 1 to 3 percent slopes, 8 miles north, 54 degrees east of the courthouse in Brady, or in a cultivated field 150 yards south of county road, 1.3 miles southwest on U.S. Highway No. 190 from its junction with Farm Road 1121 in Rochelle, then 0.9 mile south and 0.1 mile west on county road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable, sticky; many fine roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 13 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, subangular blocky structure; hard, firm but crumbly, sticky; many fine roots; few fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

B21—13 to 21 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, very fine, subangular blocky structure; hard, firm, sticky; few fine roots; few fine pores; calcareous; moderately alkaline; gradual, wavy boundary.

B22ca—21 to 32 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, very fine, subangular blocky structure; hard, firm, sticky; few fine roots; few fine pores; a few, fine, soft masses, a few concretions, and a few films and threads of calcium carbonate; 20 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—32 to 63 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable, sticky; about 30 percent is pinkish-white concretions of calcium carbonate 1 to 15 millimeters in diameter and a few soft lumps of calcium carbonate; 70 percent calcium carbonate equivalent; calcareous; moderately alkaline; diffuse, wavy boundary.

C2ca—63 to 84 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; massive; hard, friable, slightly sticky; a few concretions and soft masses of segregated calcium carbonate; 50 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness.

The A horizon ranges from 10 to 18 inches in thickness, from clay loam to silty clay loam, and from brown to dark grayish brown. The B2 horizon ranges from 14 to 25 inches in thickness, from clay loam to silty clay, and from brown or light brown to reddish brown. The content of films, threads, and concretions of calcium carbonate in this horizon ranges from less than 1 percent in the upper part to as much as 10 percent in the lower part. The C1ca horizon ranges from 6 to 35 inches in thickness and from silty clay loam to silty clay. The C1ca and C2ca horizons range from white to pink. Visible carbonates in the form of soft lumps and concretions make up from about 10 to 50 percent of the soil mass. The C2 horizon ranges from loam to silty clay.

Nuvalde clay loam, 1 to 3 percent slopes (NuB).—This soil is on plains and stream terraces. Areas are oblong to irregular in shape and are 200 to 300 acres in size. Slopes are dominantly 1.5 to 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Cho, Karnes, Mereta, Rowena, Sagerton, and Tobosa soils. Cho, Karnes, and Mereta soils commonly are a few inches to a few feet higher on the landscape than Nuvalde soils, and Rowena soils are a few feet lower. Sagerton and Tobosa soils are in drainageways. These inclusions are oval, oblong, or elongated areas 1 to 5 acres in size.

About 90 percent of the acreage of this Nuvalde soil is cultivated. Dryland capability unit IIe–3; irrigated capability unit IIe–3; Deep Upland range site.

Nuvalde-Mereta complex, 2 to 5 percent slopes (NvC).—This complex is on shallow valley walls of drainageways. Areas are oblong to elongated in shape, 100 to 400 yards in width, up to a mile in length, and 30 to 200 acres in size. Surfaces are complex, and slopes are dominantly 2 to 4 percent.

About 50 percent of this complex is Nuvalde clay loam, 20 percent is Mereta clay loam, and 30 percent is other soils. Nuvalde soils dominate the complex, along with other soils in patterns too intricate to be delineated at the scale of mapping used. Mereta soils are in elongated and oblong areas, 1 to about 7 acres in size, in the upper third of the mapping unit.

The Nuvalde soil has a surface layer of dark grayish-brown clay loam about 13 inches thick. The next layer is clay loam about 19 inches thick. It is brown in the upper part and light brown in the lower part. The underlying material is pink clay loam that has a high content of lime.

The Mereta soil has a surface layer of dark grayish-brown clay loam about 5 inches thick. The next layer is dark-brown clay loam about 14 inches thick. The underlying material is caliche that has a cemented layer in the upper 4 inches.

Included with these soils in mapping are areas of Cho, Karnes, and Rowena soils. Cho soils are in the upper third of the mapping unit in oblong to round areas 1 to about 5 acres in size. Cho soils commonly are at the crest of the steepest part of the slope. Karnes soils are mainly in the lower two-thirds of the mapping unit in oblong-shaped areas 1 to about 10 acres in size. Rowena clay loam is in a few drainageways that cross the mapping unit, and areas are less than 5 acres in size. These inclusions make up less than 10 percent of the total acreage.

About 60 percent of the acreage of this complex is cultivated. The rest is used for native range. Dryland capability unit IIIe–7; Nuvalde soil in Deep Upland range site, Mereta soil in Shallow range site.

Owens Series

The Owens series consists of shallow, well-drained soils on uplands. These soils formed in clayey material weathered from shale. Coarse fragments and stones on the surface range from few to many and in places cover about 50 percent of the surface area. Slopes range from 1 to 30 percent.

In a representative profile the surface layer is brown clay about 6 inches thick. The next layer is light olive-brown clay, about 12 inches thick, that contains a few secondary carbonates. The underlying material is pale-olive shale.

Internal drainage and permeability are very slow. Runoff is rapid. Available water capacity is low.

Owens soils are used for range.

Representative profile of Owens clay in an area of Owens and Tarrant soils, hilly, 19.4 miles north and 4 degrees east of the courthouse in Brady, or in a pasture

one-fourth mile south of the Colorado River and 100 yards east of Bluff Creek, 4.8 miles northeast of Fife:

A1—0 to 6 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate, fine, subangular and angular blocky structure; very hard, firm; many roots; few subrounded limestone pebbles up to 19 millimeters in diameter; hard limestone cobblestones and boulders cover about 40 percent of surface; pale-brown surface crust, 3 millimeters thick, forms checks on drying; calcareous; moderately alkaline; gradual, smooth boundary.

Bca—6 to 18 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, very fine, angular blocky structure; extremely hard, very firm; few roots; few lime concretions 3 to 19 millimeters in diameter; few shale fragments in lower 6 inches; calcareous; moderately alkaline; gradual, smooth boundary.

C—18 to 60 inches, pale-olive (5Y 6/3) shale, olive (5Y 5/3) moist; weathered in upper 5 inches and has few roots in crevices; bedding planes evident in lower part; few nodular lime concretions in upper 5 inches; calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness. It is 40 to 50 percent clay. The number of limestone fragments, cobblestones, and boulders on the surface ranges from few to many. In places fragments cover about 50 percent of the surface area. Boulders are up to 3 feet thick and 8 feet long. The upper part of the A horizon is as much as 10 percent coarse fragments. The B horizon is about 5 percent concretions.

The A horizon ranges from 4 to 8 inches in thickness and from yellowish brown or brown to dark brown. The B horizon ranges from 7 to 14 inches in thickness and from olive yellow or light olive brown to reddish brown. The C horizon is olive-brown, grayish-brown, and pale-olive shale.

Owens-Blanket association, undulating (OBC).—This mapping unit is on uplands dissected by drainageways. It is about 50 percent Owens soil, 25 percent Blanket soil, and 25 percent Bonti, Karnes, Mereta, Nuvalde, Pedernales, and Rochelle soils. Areas are oblong and are 50 to sevearal hundred acres in size. The landscape is one of long, predominantly west-facing, complex slopes. Slopes are dominantly 1 to 8 percent, but on some short, east-facing scarps they are as much as 20 percent. Shallow valleys and low, oval ridges are typical of the upper parts of the longer slopes, and plane surfaces and gullies of the lower parts.

The Owens soil is between natural drainageways and on foot slopes and short scarps. Slopes are complex. They are mainly 1 to 8 percent but range from 10 to 20 percent.

The Blanket soil occupies the upper half to two-thirds of the slopes bordering natural drainageways. It has concave slopes of 1 to 3 percent. Areas are 5 to 30 acres in size.

The nearly level to sloping Karnes, Mereta, Nuvalde, and Rochelle soils are on old alluvial ridges 50 to 150 yards wide and up to a mile long. Bonti soils occur as bands up to 50 yards wide and a quarter of a mile long on the upper third of short, steep scarps that are predominantly Owens soils. Pedernales soils are beside Blanket soils on the weakly concave upper parts of slopes bordering the drainageways.

The surface layer of the Owens soil is brown clay to clay loam about 6 inches thick. It is commonly covered with 1 to 4 inches of waterworn gravel. The next layer is light olive-brown clay about 12 inches thick. The underlying material is weathered, olive-brown shale.

The surface layer of the Blanket soil is brown clay loam about 13 inches thick. The next 18 inches is brown clay loam. The next 20 inches is clay loam that is reddish brown in the upper part and yellowish red in the lower part. Below this is reddish-yellow clay loam that contains threads and concretions of lime.

The entire acreage is used for range. Owens soil: Dryland capability unit VIIs–1; Shaly Hill range site. Blanket soil: Dryland capability unit IIe–2; Deep Upland range site.

Owens-Krum association, rolling (OKD).—This mapping unit is on rolling uplands between old, high terraces and recently formed alluvial soils. It is about 50 percent Owens soil, 20 percent Krum soil, and 30 percent Bonti, Cho, Miller, Nuvalde, Rochelle, and Sagerton soils. Areas are oblong in shape and are several hundred acres in size. The landscape is highly dissected by drainageways that become deeply incised near major streams.

The Owens soil is on smooth and rounded hills, ridges, and scarps in the upper three-fourths of the unit. Surfaces are complex, and slopes are dominantly 5 to 10 percent.

The Krum soil is on valley floors and in drainageways. Slopes range from 1 to 3 percent but are dominantly about 1.5 percent.

Bonti soils occupy basal slopes below Owens soils. The rest of the less extensive soils form the caps of ridges and knobs at higher elevations.

A waterworn gravel pavement about 2 to 6 inches thick covers 75 percent of the Owens soil. The surface layer is brown clay about 5 inches thick. The next layer is light olive-brown clay about 10 inches thick. The underlying material is pale-olive shale. Geological erosion and accelerated erosion have been active on steep slopes. Sloughed out, or severely eroded, areas 1 to 5 acres in size where raw shale is exposed account for about 10 percent of the acreage of the Owens soil.

The Krum soil has an 8-inch surface layer of dark grayish-brown silty clay. The next layer, to a depth of 42 inches, is brown silty clay. The underlying material is silty clay. It is strong brown in the upper part and brown in the lower part.

The entire acreage is used for range. Owens soil: Dryland capability unit VIIs–1; Shaly Hill range site. Krum soil: Dryland capability unit IIe–3; Deep Upland range site.

Owens and Tarrant soils, hilly (OTE).—This mapping unit is on short, steep scarps, 20 to 70 feet high, bordering plains and limestone plateaus. It is about 45 percent Owens soil, 30 percent Tarrant soil, and 25 percent Brackett, Kavett, Krum, Tobosa, and Valera soils. Areas are 100 to 300 yards wide and several miles long and range from about 100 acres to 1,000 acres in size. Some mapped areas have benches, or gently sloping bands, above outcrops of successive limestone ledges along the upper parts of the scarps.

The Owens soil occupies the lower parts of the mapping unit. Slopes are complex. The Brackett soils occur as narrow bands of 1 to 3 acres around low, rounded hills above the Tarrant soil. Valera, Kavett, and Tobosa soils are in bands of 1 to 10 acres above the limestone ledges. The Krum soils are in elongated areas of 5 to 10 acres on valley floors below the Owens soil.

The Owens soil has the profile described as representative of the series. Slopes are mainly 18 percent, but range from 10 to 30 percent. Part of the surface area is covered with boulders 2 to 3 feet thick and as much as 8 feet long.

The Tarrant soil formed on the limestone ledges capping the upper 10 to 40 percent of the mapping unit. Some isolated strips, a few feet wide, are associated with the lower lying limestone ledges and scattered alluvial limestone remnants in areas of the Owens soil.

The surface layer of the Tarrant soil is very dark grayish-brown clay about 8 inches thick and about 40 percent limestone cobblestones and boulders. The next layer is brown clay loam about 6 inches thick and about 80 percent limestone fragments. Limestone cobblestones and boulders cover 40 to 60 percent of the surface area.

Geological erosion and accelerated erosion have been active where ground cover is inadequate. In a few, steep, sloughed out areas up to 3 acres in size, raw shale is exposed. Sheet and gully erosion are evident on about 20 percent of the acreage of the Owens soil.

The entire acreage is used for range. Dryland capability unit VIIs–1; Owens soil in Shaly Hill range site, Tarrant soil in Low Stony Hill range site.

Pedernales Series

The Pedernales series consists of deep, well-drained soils that formed in old alluvium. These soils are mainly on old high terraces and valley floors. Surfaces are plane to complex, and slopes are 0 to 3 percent.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. Below this is sandy clay about 27 inches thick. It is reddish brown in the upper part and red in the lower part. The next layer is yellowish-red sandy clay loam.

Permeability is moderately slow. Runoff and internal drainage are medium. The available water capacity is high.

Most areas of Pedernales soils are cultivated. A few are used for range.

Representative profile of Pedernales fine sandy loam, 0 to 1 percent slopes, 20 miles north, 15 degrees west of the courthouse in Brady, in a cultivated field 310 yards east of field fence, 1.4 miles north from the intersection of Farm Roads 765 and 2635:

Ap—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; hard, friable; many fine roots; few, round, siliceous pebbles up to 9 millimeters in diameter; neutral; abrupt, smooth boundary.

B21t—7 to 17 inches, reddish-brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; moderate, medium, prismatic structure and moderate, medium, blocky structure; very hard, firm; numerous fine roots; few fine pores; common distinct clay films on ped surfaces; neutral; clear, smooth boundary.

B22t—17 to 34 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; moderate, medium, blocky structure; very hard, firm; few fine roots; few fine pores; common distinct clay films on ped surfaces; neutral; gradual, smooth boundary.

B23t—34 to 58 inches, yellowish-red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak, coarse, blocky structure; hard, firm; few fine roots; sand grains are bridged; few thin clay films on ped surfaces; noncalcareous; moderately alkaline; gradual, wavy boundary.

B3t—58 to 86 inches, yellowish-red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak, coarse, subangular blocky structure; very hard, friable; porous; sand grains are bridged; few films and threads of lime and few calcium carbonate concretions 1 to 2 millimeters in diameter; calcareous; moderately alkaline.

The solum ranges from 60 to 86 inches in thickness.

The A horizon is 6 to 8 inches thick and ranges from brown to reddish brown. The B21t and B22t horizons combined are 18 to 35 inches thick. They range from clay loam to sandy clay, from 35 to about 55 percent clay, and from brown to reddish brown and red. The B23t horizon ranges from 10 to 30 inches in thickness, from yellowish red to reddish brown, and from clay loam in the upper part to sandy clay loam in the lower part. The B3t horizon ranges from sandy clay loam to clay loam and from yellowish red to reddish yellow.

The Pedernales soils in McCulloch County are outside the defined range of the Pedernales series in that the solum is more than 60 inches thick. This difference does not alter use and management.

Pedernales fine sandy loam, 0 to 1 percent slopes (PeA).—This soil is on stream terraces. Areas are oblong to irregular in shape and are 20 to about 150 acres in size. Surfaces are weakly concave to plane, and slopes are dominantly about 0.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Miles, Rochelle, and Sagerton soils. Miles and Rochelle soils are a few inches to a few feet lower. These inclusions range from 1 to 5 acres in size and make up less than 15 percent of the total acreage.

Almost all areas of this Pedernales soil are cultivated. A few are used for range. Dryland capability unit IIc–1; irrigated capability unit I–1; Tight Sandy Loam range site.

Pedernales fine sandy loam, 1 to 3 percent slopes (PeB).—This soil is on stream terraces and in valleys below limestone hills. Areas are oblong to irregular in shape and are 10 to about 100 acres in size. Surfaces are plane to complex, and slopes are dominantly 1.5 to 2 percent. The surface layer of this soil is reddish-brown fine sandy loam about 6 inches thick. The next layer is sandy clay about 30 inches thick. It is brown in the upper part and reddish brown in the lower part. Below this is reddish-brown sandy clay loam.

Included with this soil in mapping are areas of Miles, Rochelle, Rowena, and Sagerton soils. Miles and Rochelle soils are a few inches to a few feet higher on the landscape than Pedernales soils, and Rowena and Sagerton soils are slightly lower. These inclusions make up less than 15 percent of the total acreage.

Most areas of this Pedernales soil are cultivated. A few are used for range. Dryland capability unit IIIe–1; irrigated capability unit IIe–6; Tight Sandy Loam range site.

Pontotoc Series

The Pontotoc series consists of deep, well-drained soils that formed in loamy materials weathered from sandstone. Surfaces are plane to complex. Slopes range from 1 to 5 percent.

In a representative profile the surface layer is fine sandy loam about 12 inches thick. It is dark reddish

brown in the upper part and dusky red in the lower part. The next 11 inches is dusky red fine sandy loam. The next layer, about 13 inches thick, is dark reddish-brown fine sandy loam. Below this is dark reddish-brown sandy clay loam about 36 inches thick. The underlying material is dark reddish-gray, fractured sandstone.

The available water capacity and permeability are moderate. Runoff is slow.

Most areas of Pontotoc soils are cultivated. A few are used for range.

Representative profile of Pontotoc fine sandy loam, 1 to 5 percent slopes, 12.2 miles south and 44 degrees east of the courthouse in Brady, in a cultivated field 0.2 mile northwest of windmill, 0.4 mile due west of Voca:

Ap—0 to 5 inches, dark reddish-brown (2.5YR 3/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak, very fine, granular structure; slightly hard, very friable; common roots; few subrounded quartz pebbles 2 to 5 millimeters in diameter; slightly acid; abrupt, smooth boundary.

A1—5 to 12 inches, dusky red (10R 3/4) fine sandy loam, dusky red (10R 3/4) moist; weak, fine, granular structure and very fine subangular blocky structure; slightly hard, very friable; common roots; porous; slightly acid; gradual, smooth boundary.

B1—12 to 23 inches, dusky red (10R 3/4) fine sandy loam, dusky red (10R 3/4) moist; weak, very fine, subangular blocky structure; slightly hard, very friable; few roots; common fine and medium pores; slightly acid; gradual, smooth boundary.

B21t—23 to 36 inches, dark reddish-brown (2.5YR 3/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak, very fine, subangular blocky structure; hard, friable; common fine and medium pores; clay films in pores; slightly acid; gradual, smooth boundary.

B22t—36 to 57 inches, dark reddish-brown (2.5YR 3/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak, very fine, subangular blocky structure; hard, friable; few roots; common fine and medium pores; clay films in pores; slightly acid; clear, irregular boundary.

B23t—57 to 72 inches, dark reddish-brown (2.5YR 3/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak, very fine, subangular blocky structure; hard, friable; fine and medium pores; clay films in pores; about 5 to 10 percent reddish angular and subrounded sandstone fragments; slightly acid; clear, irregular boundary.

R—72 to 76 inches, fractured sandstone, dark reddish-gray (10R 3/1) exterior, steel-blue interior; slightly acid.

The solum ranges from 60 to 80 inches in thickness. Reaction is neutral or slightly acid in the A horizon.

The A horizon ranges from 7 to 14 inches in thickness and from dark reddish brown to dusky red. The B1 horizon ranges from 5 to 12 inches in thickness and from reddish brown to dusky red. The B21t horizon ranges from 5 to 14 inches in thickness and from dark reddish brown to dusky red. The B22t and B23t horizons combined are 15 to 41 inches thick and range from dark reddish brown or red to dark red. Sandstone fragments up to 3 inches in diameter range from a few to about 15 percent in the lower few inches. The Bt horizon, below a depth of 40 inches, is fine sandy loam to sandy clay loam that is 18 to about 25 percent clay. The R layer is fractured, red or dark reddish-gray, thick-bedded sandstone bedrock.

Pontotoc fine sandy loam, 1 to 5 percent slopes (PoC).—This soil occurs as oblong bands 20 to 150 acres in size. It is in shallow valleys adjacent to short, reddish, sandstone scarps. Slopes are dominantly 3.5 to 4 percent.

Included with this soil in mapping are areas of Acove, Cobb, and Yates soils that occur as oblong to irregular bands 1 to 5 acres in size. Acove and Cobb soils are at the same level, below Pontotoc soils, and Yates soils are on ridges slightly above those soils. These inclusions make up less than 10 percent of the total acreage.

About 60 percent of the acreage of this Pontotoc soil is cultivated. A few acres are used for range. Dryland capability unit IIIe–3; irrigated capability unit IIIe–2; Sandy Loam range site.

Randall Series

The Randall series consists of deep, somewhat poorly drained soils that formed in calcareous, clayey old alluvium. Surfaces are plane to weakly concave. Slopes range from 0 to 1 percent.

In a representative profile the surface layer is dark-gray clay about 38 inches thick. The next layer is gray clay about 16 inches thick. The underlying material is gray clay that has a weak accumulation of lime.

Gilgai microrelief is common in undisturbed areas but is destroyed under cultivation (fig. 14). When these soils are dry, they crack to a depth of more than 30 inches, and water enters the soil rapidly. When these soils are wet, the cracks close, and water movement into the soil is very slow. Permeability is very slow. The available water capacity is high.

Most areas of Randall soils are cultivated. A few are used for range.

Representative profile of Randall clay, 18.8 miles north and 17 degrees west of the courthouse in Brady, in a cultivated field 100 feet north of pavement, 100 feet east of the junction of Farm Roads 765 and 2635 north of Lohn:

Ap—0 to 5 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, fine, granular structure; very hard, very firm, sticky and plastic; few fine roots; few chert pebbles; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—5 to 38 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, angular blocky structure that grades to moderate, medium, angular blocky structure below a depth of 15 inches; extremely hard, very firm; well-developed slickensides that have grooved striations below a depth of 20 inches; wedge-shaped peds; parallelepipeds tilted about 30 degrees from horizontal; calcareous; moderately alkaline; gradual, wavy boundary.

AC—38 to 54 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, angular blocky structure; extremely hard, very firm; parallelepipeds tilted about 30 to 40 degrees from horizontal; well-developed, intersecting, grooved slickensides; shiny pressure faces on ped surfaces; wedge-shaped peds; few fine calcium carbonate concretions in lower 6 inches; calcareous; moderately alkaline; gradual, wavy boundary.

C—54 to 64 inches, gray (10YR 6/1) clay, gray (10YR 5/1) moist; few reddish-yellow and brown streaks; few calcium carbonate concretions; calcareous; moderately alkaline.

Depth to underlying loamy material or rock is typically more than 72 inches. The clay content of the A1 and AC horizons is 45 to about 60 percent.

The A horizon ranges from 12 inches on microhighs to 40 inches on microlows. It ranges from dark gray to very dark gray. The AC horizon ranges from 15 to 30 inches in thickness and from gray to dark grayish brown. The C horizon ranges from gray to grayish brown. Lime concretions in this horizon range from few to about 5 percent.

Figure 14.—Gilgai microrelief on Randall clay in native pasture.

Randall clay (Ra).—This soil is in areas oblong to oval in shape and 50 to 150 acres in size. It is a few inches to a few feet lower on the landscape than the surrounding soils. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.7 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Rowena and Tobosa soils that make up no more than 5 percent of the total acreage. These inclusions are irregular to oval in shape and 5 acres or less in size. They are slightly higher on the landscape than Randall soils.

Most of the acreage of this Randall soil is cultivated (fig. 15). A few areas are used for native range. Dryland capability unit IIIw–1; Deep Upland range site.

Randall-Reap complex (Rr).—This complex consists of nearly level soils in a pattern of microbasins and microknolls that are too intricate to be mapped separately at the scale of mapping used. It is about 58 percent Randall soil, 30 percent Reap soil, and 12 percent inclusions of other soils. Areas are oblong to irregular in shape and are 20 to more than 1,000 acres in size. A typical area is about 58 percent microbasins and 40 percent microknolls and short ridges. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.5 percent.

The Randall soil is in the microbasins. The Reap soil forms the crest of microknolls. Tobosa and other soils are on the lower parts of the microknolls between the Randall and Reap soils. The basins are rounded to oblong in shape and 12 to 24 feet across. The knolls are 12 to 20 feet across and are oblong to elongated in shape. The crests of the microknolls are 6 to 12 inches higher than the bottoms of the microbasins. Gilgai microrelief is pronounced in native pasture but is destroyed in cultivated fields.

The Randall soil has a surface layer of dark-gray clay about 38 inches thick. The next layer is gray clay about 16 inches thick. It is underlain at a depth of about 54 inches by grayish-brown clay that has a weak accumulation of lime.

The Reap soil has a surface layer of grayish-brown clay about 17 inches thick. The next layer is brown clay about 41 inches thick. The underlying material is brown clay.

The included soils mapped with this complex are Mereta, Rowena, and Salga soils that are at the same elevation or slightly higher on the landscape. These inclusions are 1 to 5 acres in size.

Most areas of this complex are cultivated. A few are used for range. Dryland capability unit IIs–2; irrigated capability unit IIs–2; Deep Upland range site.

Figure 15.—Cotton on Randall clay.

Reap Series

The Reap series consists of deep, nearly level to gently sloping, well-drained soils that formed in clayey old alluvium. These soils are on uplands, on the crests of ridges and knolls in an intricate gilgai microrelief with other soils. Surfaces are plane to complex, and slopes are 1 to 3 percent.

In a representative profile the surface layer is grayish-brown clay about 17 inches thick. The lower layers are brown clay about 41 inches thick. The underlying material is brown clay.

Gilgai microrelief, under native conditions, consists of a series of basins and knolls in nearly level areas and valleys and ridges on gentle slopes.

If Reap soils are dry, they crack to a depth of more than 20 inches, and water enters the soil rapidly. If these soils are wet, the cracks close, and water movement into the soil is very slow.

Permeability is very slow. Runoff is slow to medium. The available water capacity is high.

Most areas of Reap soils are used for crops. A few are used for range.

Representative profile of Reap clay in an area of Reap-Tobosa complex, 1 to 3 percent slopes, 18 miles north, 17 degrees west of the courthouse in Brady, 185 feet east of pasture trail and 0.8 mile south of pasture gate, 4.25 miles north of Lohn on Farm Road 2635, then 1.75 miles west on county road:

A11—0 to 5 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine, subangular blocky structure and weak granular structure; very hard, firm; many roots; common very fine pores; few earthworm casts; calcareous; moderately alkaline; clear, wavy boundary.

A12—5 to 17 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine, angular and subangular blocky structure; very hard, firm; common roots; few very fine calcium carbonate concretions or fragments; calcareous; moderately alkaline; gradual, wavy boundary.

A13—17 to 26 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, fine and medium angular blocky structure; very hard, firm; few roots; pressure faces on some peds; estimated 1 percent soft calcium carbonate masses 1 to 3 millimeters thick and up to 10 millimeters across long axis; old filled cracks contain darker material; calcareous; moderately alkaline; gradual, wavy boundary.

AC1—26 to 42 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, medium, angular blocky structure; extremely hard, very firm; few roots; pressure faces on peds; estimated 2 percent soft calcium carbonate masses 1 to 3 millimeters thick and 3 to 10 millimeters across long axis; old filled cracks contain darker material; calcareous; moderately alkaline; gradual, wavy boundary.

AC2—42 to 58 inches, brown (7.5YR 5/4) clay, brown (7.5YR 5/4) moist; moderate, medium, angular blocky struc-

ture; extremely hard, very firm; few roots; few slickensides; few parallelepipeds; few pressure faces; slightly less calcium carbonate masses than in horizon above; few ironstone fragments; calcareous; moderately alkaline; gradual, wavy boundary.

C—58 to 65 inches, brown (7.5YR 5/4) clay, brown (7.5YR 5/4) moist; massive, but has few slickensides and pressure faces; extremely hard, very firm; few calcium carbonate specks; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. The clay content ranges from 45 to 60 percent.

The A horizon ranges from 9 to 36 inches in thickness and from dark grayish brown or grayish brown to brown. The AC horizon ranges from 16 to 45 inches in thickness and from brown or light brown to grayish brown. The C horizon ranges from brown or pale brown to light yellowish brown. The calcium carbonate content ranges from a few concretions and soil masses to about 15 percent concretions.

Reap-Tobosa complex, 1 to 3 percent slopes (RtB).—The soils in this complex are in an intricate gilgai microrelief of valleys and ridges. Areas are oblong to irregular in shape and are 20 to more than 1,000 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 1.5 to 2 percent. These soils are mapped as a complex because they are so intermixed that they could not be shown separately at the scale of mapping used.

This complex is about 60 percent Reap soil, 20 percent Tobosa soil, and 20 percent other soils. The gilgai microrelief, under native conditions, is a series of microvalleys and microridges up to 500 yards long, oriented with the slope. The microridges are 33 to 75 feet across, and the microvalleys are 9 to 12 feet across. The microrelief is about 80 percent microridges and 20 percent microvalleys.

The Reap soil is on the upper 60 percent of ridge crests, and the Tobosa soil is along the lower 20 percent of the ridges and borders other soils that are in the microvalleys. The gilgai microrelief is destroyed under cultivation.

The Reap soil has the profile described as representative of the series.

The Tobosa soil has a surface layer of dark grayish-brown clay about 28 inches thick. The next layer is brown clay about 30 inches thick. The underlying material is light-brown clay that has a weak lime accumulation.

Included with this complex in mapping are areas, 1 to 10 acres in size, of Nuvalde and Rowena soils. These inclusions occur as thin irregular bands or isolated oval-shaped spots that are mainly in the upper parts of the complex.

About half of the acreage of this complex is cultivated, and about half is used for range. Dryland capability unit IIIe–2; irrigated capability unit IIIe–1; Deep Upland range site.

Rochelle Series

The Rochelle series consists of well-drained soils on uplands. These soils are moderately deep over caliche. They formed in thin layers of gravelly old alluvium, mostly along the edges of terraces and old alluvial remnants. Surfaces are weakly convex, and slopes are 0 to 3 percent.

In a representative profile the surface layer is reddish-brown fine sandy loam about 5 inches thick. Below this is reddish-brown sandy clay loam about 8 inches thick. The next layer is dark-red gravelly sandy clay loam about 19 inches thick. The underlying material is calcareous, gravelly alluvium that has layers of coarse sand and some shale fragments.

Permeability is moderately slow. Surface runoff and internal drainage are medium. The available water capacity is low.

A small acreage of Rochelle soils is cultivated in fields of other soils. Most larger areas that were formerly cultivated have been returned to range.

Representative profile of Rochelle fine sandy loam, 0 to 3 percent slopes, 20.5 miles north, 13 degrees west of the courthouse in Brady, in a pasture 220 yards north and 90 yards east from a right angle turn in county road, 1.6 miles north and 0.8 mile east of the intersection of Farm Roads 2635 and 765 north of Lohn:

A1—0 to 5 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure and medium granular structure; hard, friable; many roots; few quartz pebbles; neutral; abrupt, smooth boundary.

B21t—5 to 13 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky; very hard, friable; common roots; many fine pores; 10 percent is siliceous pebbles; few thin clay films; neutral; clear, wavy boundary.

B22t—13 to 32 inches, dark-red (2.5YR 3/6) gravelly sandy clay loam, dark red (2.5YR 3/6) moist; moderate, coarse, prismatic structure parting to moderate, fine, angular blocky; very hard, firm; few roots; estimated 30 percent is siliceous pebbles; few cobblestones; clay films on peds; neutral; clear, wavy boundary.

IIC1ca—32 to 48 inches, about 90 percent waterworn quartz pebbles and interstices filled with pink to reddish-yellow coarse sandy loam; cemented calcium carbonate pendants one-fourth inch long on the underside of pebbles; calcareous; moderately alkaline; diffuse, wavy boundary.

IIC2ca—48 to 60 inches, about 70 percent waterworn quartz pebbles, 15 to 20 percent redeposited shale fragments, and 5 to 10 percent coarse sand; few soft calcium carbonate masses one-fourth to three-fourths inch in diameter; cemented calcium carbonate pendants on underside of pebbles; a few layers, 2 to 4 inches thick, of fine gravel and coarse sand with no shale fragments; calcareous in matrix; moderately alkaline.

The solum ranges from 28 to 40 inches in thickness. Reaction in the A and Bt horizons is neutral or mildly alkaline. The clay content in the upper 20 inches of the Bt horizon is 28 to 35 percent.

The A horizon ranges from 4 to 6 inches in thickness and from reddish brown to yellowish brown. The B21t horizon ranges from 8 to 14 inches in thickness, from fine sandy loam to sandy clay loam, and from brown to reddish brown. The B22t horizon ranges from 12 to 24 inches in thickness, from dark red or reddish brown to dark reddish brown, and from gravelly sandy clay loam to gravelly sandy clay. The content of waterworn gravel ranges from 20 to 35 percent in the upper 20 inches of the Bt horizon to about 50 percent at lower depths. The IICca horizon consists of varying proportions of caliche, layers of waterworn gravel, coarse sand, and redeposited shale and sandstone fragments. The upper part of this horizon commonly contains pinkish caliche and stratified and intermixed gravel and coarse sand. The gravel content ranges from about 10 to 90 percent. The IIIb horizon,

where present, is reddish-brown clay and about 50 to 90 percent waterworn gravel.

Rochelle fine sandy loam, 0 to 3 percent slopes (RuB).—This soil is in areas oval to irregular in shape and 10 to 100 acres in size. Slopes are dominantly 1.5 to 2 percent.

Included with this soil in mapping are areas of Miles and Pedernales soils that occur as narrow bands bordering the lower slopes of Rochelle soils and are 1 to 5 acres in size. These inclusions make up no more than 10 percent of the total acreage.

About 10 to 15 percent of the acreage of this Rochelle soil is cultivated in fields of other soils. Most of the previously cultivated acreage has been returned to range. Dryland capability unit IVs–1; Sandy Loam range site.

Rowena Series

The Rowena series consists of well-drained soils on uplands that formed in calcareous old alluvial sediments. These soils are moderately deep over caliche. Surfaces are simple to complex, and slopes are 0 to 3 percent.

In a representative profile the surface layer is brown clay loam about 7 inches thick. The next layer is reddish-brown clay about 24 inches thick. The underlying material is reddish-yellow silty clay loam that contains concretions and soft masses of lime.

Internal drainage and permeability are moderately slow. Runoff is slow. The available water capacity is high. These soils crack if dry, and cracks are 1 to 3 centimeters wide at a depth of 20 inches.

Most areas of Rowena soils are cultivated. A few are used for range.

Representative profile of Rowena clay loam, 0 to 1 percent slopes, 12.9 miles north of the courthouse in Brady, 2 miles south of intersection of Farm Roads 504 and 2635 in Lohn, then 2.4 miles west on county road, in a cultivated field 42 yards south from the center of county road:

Ap—0 to 7 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, very fine, subangular blocky structure; hard, friable; many roots; porous peds; surface crust crushes easily; surface cracks ¼ to ½ inch wide; few angular and subrounded chert fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

B21—7 to 14 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; compound moderate, very fine, subangular blocky and angular blocky structure; very hard, firm; common roots; few pores; shiny pressure faces on some peds; calcareous; moderately alkaline; clear, wavy boundary.

B22—14 to 31 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5Y 3/3) moist; moderate, medium, blocky structure; very hard, firm; few pores; few cracks, ⅛ to ¼ inch wide, filled with dark-brown soil from horizon above; shiny pressure faces on ped surfaces; calcareous; moderately alkaline; clear, wavy boundary.

C1Ca—31 to 45 inches, reddish-yellow (7.5YR 8/6) silty clay loam, reddish yellow (7.5YR 7/6) moist; massive; hard, friable; about 25 percent calcium carbonate concretions and soft masses of lime, mostly ¼ to ½ inch in diameter and some as much as 1¼ inches; calcareous; moderately alkaline; gradual, wavy boundary.

C2—45 to 72 inches, reddish-yellow (5YR 7/6) silty clay loam, reddish yellow (5YR 6/6) moist; massive; hard, friable; about 10 percent calcium carbonate concretions up to one-half inch in diameter; calcareous; moderately alkaline.

The solum ranges from 22 to 40 inches in thickness. The A horizon and the upper part of the B horizon are predominantly calcareous.

The A horizon ranges from 5 to 10 inches in thickness and from brown to dark grayish brown. The B horizon ranges from clay loam to clay and has a clay content of 35 to about 50 percent. It is 2 to 5 percent higher in clay content than the A horizon. The B horizon ranges from dark grayish brown to reddish brown and from 15 to 30 inches in thickness. A B3 horizon, which occurs in about 8 percent of the acreage of this soil, ranges from reddish brown to brown, from clay loam to clay, and from 0 to 12 inches in thickness. The C horizon has a 20 to 60 percent calcium carbonate equivalent, and the lime content decreases by at least 5 percent with depth. The content of concretions and soft masses of calcium carbonate, up to 1.5 inches in diameter, ranges from 15 to 40 percent in the upper part of the C horizon. This horizon ranges from reddish yellow to yellowish red.

Rowena clay loam, 0 to 1 percent slopes (RwA).—This soil is in areas oblong to irregular in shape and 15 to several hundred acres in size. Surfaces are plane to weakly concave, and slopes are dominantly about 0.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Mereta, Randall, Salga, and Tobosa soils. Tobosa and Randall soils are in areas oval to oblong in shape and 1 to 5 acres in size. They are on slightly lower lying positions than this Rowena soil. Mereta and Salga soils are at the same level or slightly higher than this Rowena soil and are in areas oblong to irregular in shape and 1 to 5 acres in size.

Most of the acreage of this Rowena soil is cultivated. Dryland capability unit IIs–3; irrigated capability unit IIs–3; Deep Upland range site.

Rowena clay loam, 1 to 3 percent slopes (RwB).—This soil is in areas oblong to irregular in shape and 15 to several hundred acres in size. Surfaces are plane to complex, and slopes are dominantly 1.5 to 2 percent. The surface layer is brown clay loam about 7 inches thick. The next layer is reddish-brown clay about 30 inches thick. The underlying material is reddish-yellow silty clay loam. The surface layer on about 20 percent or less of this soil has been thinned by sheet erosion, and a few broad, shallow gullies have formed where slopes are 2 to 3 percent.

Included with this soil in mapping are Tobosa, Mereta, Salga, Karnes, and Cho soils. Tobosa soils are in the lower natural drainageways. Areas are oblong to oval in shape and 1 to 3 acres in size. Mereta and Salga soils are on side slopes and low ridges slightly above this Rowena soil. Areas are oblong in shape and 1 to 5 acres in size. Karnes and Cho soils are on low ridges or low knobs a few feet above this Rowena soil. Areas are 1 to 5 acres in size. These inclusions make up about 5 percent of this mapping unit.

Most of the acreage of this Rowena soil is cultivated (fig. 16). Dryland capability unit IIe–3; irrigated capability unit IIe–4; Deep Upland range site.

Rumple Series

The Rumple series consists of well-drained, moderately deep soils on uplands. These soils formed in cherty

Figure 16.—Grain sorghum harvested for ensilage. The soil, Rowena clay loam, 1 to 3 percent slopes, is terraced and contour farmed.

loamy materials weathered from fractured limestone. Surfaces are complex. The landscape is characterized by low, rounded hills that have interconnecting saddles and by shallow, weakly parabolic valleys. Slopes are 2 to 8 percent. Limestone boulders and cobblestones crop out on the crest of most ridges.

In a representative profile the surface layer is dark reddish-brown cherty clay loam about 5 inches thick (fig. 17). Below this is dark reddish-brown cherty clay loam about 5 inches thick. The next layer is red, very cherty clay about 16 inches thick. The underlying material is white and gray, indurated limestone.

Permeability is moderately slow. Surface runoff and internal drainage are medium. The available water capacity is low.

Rumple soils are used for range.

Representative profile of Rumple cherty clay loam in an area of Rumple association, undulating, 7.2 miles south and 40 degrees east of the courthouse in Brady, or 50 feet west of property line fence, 4.1 miles south of the courthouse on U.S. Highway No. 377, then southeast 5.2 miles on Texas Highway No. 71:

A1—0 to 5 inches, dark reddish-brown (5YR 3/3) cherty clay loam, dark reddish brown (5YR 2/3) moist; moderate, fine, subangular blocky and granular structure; very hard, firm; many roots; estimated 15 percent is angular chert fragments, mostly ½ to 1 inch in diameter; neutral; clear, smooth boundary.

B1t—5 to 10 inches, dark reddish-brown (5YR 3/3) cherty clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine, subangular blocky structure; very hard, firm; few thin clay films; about 25 percent is angular chert fragments less than 2 inches in diameter; a few chert cobblestones; slightly acid; clear, wavy boundary.

B2t—10 to 26 inches, red (2.5YR 4/6) very cherty clay, dark red (2.5YR 3/6) moist; moderate, fine, angular blocky structure; very hard, firm; common roots; estimated 65 percent is chert fragments less than 2 inches in diameter; a few chert and limestone cobblestones; clay films on peds; slightly acid; abrupt, wavy boundary.

R—26 to 46 inches, white and gray, indurated limestone, coarsely fractured; red clay in crevices.

The solum ranges from 20 to 40 inches in thickness. The clay content of the Bt horizon ranges from 40 to about 55 percent. Limestone intrusions extend almost to the surface on about 5 to 10 percent of the ridges and low, rounded hills.

The A horizon is brown to dark reddish-brown cherty loam to cherty clay loam 3 to 9 inches thick. The chert gravel content ranges from 15 to 35 percent in the A horizon, and gravel covers from 10 to about 50 percent of the surface area. The B1t horizon ranges from 4 to 6 inches in thickness, from reddish brown to dark reddish brown, and from cherty clay loam to cherty clay. The B2t horizon ranges from 10 to 24 inches in thickness and from reddish brown to red. The content of coarse fragments reaches a maximum in the B2t horizon, ranging from 35 to about 85 percent. The R layer is

Figure 17.—Profile of Rumple cherty clay loam. Arrow shows boundary between surface layer and subsoil.

white and gray, massive, coarsely fractured limestone; soil fines occupy less than 5 percent of the interstices.

Rumple association, undulating (RYC).—This association consists of Rumple soils and areas of Kavett, Tarrant, Tobosa, and Valera soils near the outer boundary of the mapping unit. Areas are oblong to irregular in shape and generally about 200 to more than 1,000 acres in size. Slopes are dominantly 3 to 4 percent but range from 2 to 8 percent.

Tarrant soils are on low ridges. Valera and Tobosa soils are in the lower areas of shallow valleys. Kavett soils are in the upper areas of shallow valleys and occur as narrow bands below Tarrant soils on low hills and ridges. These soils are in areas oblong to long and narrow in shape and about 1 to 10 acres in size. They make up less than 15 percent of the total acreage.

Coarse fragments in this Rumple soil limit its use to range. Dryland capability unit VIs–2; Gravelly Redland range site.

Sagerton Series

The Sagerton series consists of deep, nearly level to gently sloping, well-drained soils on terraces of uplands. These soils formed in old alluvium. Surfaces are plane to complex, and slopes are 0 to 3 percent.

In a representative profile the surface layer is brown clay loam about 7 inches thick. The next 6 inches is brown clay loam. Below this is reddish-brown clay about 12 inches thick. The next layer is clay loam that is reddish brown in the upper part and reddish yellow in the lower part and extends to a depth of 70 inches. The underlying material is olive shaly clay.

Permeability is moderately slow. Runoff is slow to medium. The available water capacity is high.

Most areas of Sagerton soils are cultivated. A few are used for range.

Representative profile of Sagerton clay loam, 1 to 3 percent slopes, 23.3 miles north, 30 degrees east of the courthouse in Brady, in a cultivated field 139 yards east of field fence, 0.2 mile east of Mercury post office on Farm Road 502, 1.4 miles north on county road, 1 mile east, then 400 yards south on private road to field fence, 185 yards east along fence to corner, then 75 yards south along fence:

Ap—0 to 7 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, very fine, granular structure; hard, friable; many roots; surface crust ¼ to ½ inch thick checks on drying; neutral; abrupt, smooth boundary.

B21t—7 to 13 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; common roots; common fine pores; few thin clay films on peds; few earthworm casts and channels; mildly alkaline; gradual, smooth boundary.

B22t—13 to 25 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; few pores; few thin clay films on peds; few earthworm channels and casts; few streaks and stains of very dark brown (10YR 2/2) on outer ped faces; few films and threads of calcium carbonate in lower 5 inches; noncalcareous in upper part, becoming calcareous in lower part; moderately alkaline; gradual, smooth boundary.

B23tca—25 to 38 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, fine, blocky structure; very hard, firm; about 2 percent carbonate in calcium carbonate concretions 1 to 3 millimeters in diameter; films and threads of lime; few streaks of very dark gray (10YR 3/1) on outer ped surfaces; calcareous; moderately alkaline; clear, smooth boundary.

B24tca—38 to 48 inches, reddish-yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 6/6) moist; weak, fine, subangular blocky structure; hard, firm; about 15 percent lime concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B25tca—48 to 70 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, fine, subangular blocky structure; very hard, firm; few calcium carbonate concretions and few soft lime masses up to one-half inch in diameter; few seams of clear sand grains; few streaks of reddish yellow and yellowish red around concretions; few rounded, smooth quartz pebbles up to one-fourth inch in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

IIC—70 to 82 inches, olive (5Y 5/3) shaly clay, olive (5Y 5/4) moist; many shale fragments in lower part; massive; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The clay content of the Bt horizon ranges from 35 to about 45 percent. Reaction is neutral or mildly alkaline in the A horizon and the upper part of the Bt horizon.

The A horizon ranges from 5 to 8 inches in thickness and from brown to reddish brown. The B21t horizon ranges from 6 to 10 inches in thickness and from reddish brown to brown. The B22t horizon ranges from 8 to 14 inches in thickness,

from clay loam to clay, and from brown to reddish brown. The B23tca horizon ranges from 15 to 20 inches in thickness, from clay loam to sandy clay loam, and from reddish brown to strong brown. The content of calcium carbonate in this horizon ranges from film and threads to about 10 percent. The B23tca horizon, if present, is thin where the solum is underlain by gravel. The B24tca horizon ranges from reddish brown or reddish yellow to red and from 10 to 16 inches in thickness. The content of lime concretions and soft masses ranges from about 5 to 20 percent, and visible carbonates are more than 30 percent. The B25tca horizon is calcareous, reddish-brown, yellowish-red, or reddish-yellow clay loam, and the lime content decreases with depth. Stratified gravel, sandstone, and shale occur in some profiles below a depth of 60 inches.

Sagerton clay loam, 0 to 1 percent slopes (SoA).—This soil is in areas oblong to irregular in shape and 10 to 150 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.8 percent. This soil has a surface layer of brown clay loam about 7 inches thick. Below this is brown clay about 8 inches thick. The next layer is reddish-brown clay loam about 55 inches thick. The underlying material is olive shaly clay.

Included with this soil in mapping are areas of Miles, Pedernales, and Rowena soils and a soil that is similar to this Sagerton soil, but has a lighter colored surface layer. Miles and Pedernales soils are at slightly higher elevations than this Sagerton soil, Rowena soils and the light-colored soil are in about the same landscape pattern as this Sagerton soil. These inclusions are 1 to 5 acres in size and make up no more than 15 percent of the total acreage.

Most areas of this Sagerton soil are cultivated. A few are used for range. Dryland capability unit IIc–2; irrigated capability unit I–2; Deep Upland range site.

Sagerton clay loam, 1 to 3 percent slopes (SoB).—This soil is in areas oblong to irregular in shape and 20 to more than 100 acres in size. Surfaces are plane to complex, and slopes are dominantly 1 to 1.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are Miles, Pedernales, Rochelle, and Rowena soils and a soil similar to this Sagerton soil, except for its light-colored surface layer. Miles, Pedernales, and Rochelle soils are a few inches to a few feet higher on the landscape than this Sagerton soil. Rochelle soils are on low, rounded rises. Rowena soils and the soil that has a light-colored surface layer are in about the same landscape pattern as this Sagerton soil. These inclusions are 1 to 5 acres in size and make up no more than 15 percent of the total acreage. In a few areas up to 10 acres in size, where slopes are 2 to 3 percent, moderate sheet erosion is evident and a few gullies that are crossable with farm machinery are present.

Most areas of this Sagerton soil are cultivated. A few are used for range. Dryland capability unit IIe–2; irrigated capability unit IIe–2; Deep Upland range site.

Salga Series

The Salga series consists of deep, well-drained soils on uplands. These soils formed in calcareous old alluvium. Slopes are 0 to 1 percent.

In a representative profile the surface layer is dark grayish-brown clay loam about 6 inches thick. The next 10 inches is brown clay loam. Below this is reddish-brown clay loam about 9 inches thick. The underlying material is reddish-yellow clay loam that contains many concretions and soft masses of lime.

Permeability is moderate. Runoff is slow to medium. The available water capacity is high.

Salga soils are well suited to cultivation. Some areas are in range.

Representative profile of Salga clay loam, 0 to 1 percent slopes, 18.6 miles north, 57 degrees west of the courthouse in Brady, 40 feet north of county road, 1 mile south and 0.55 mile east of the Salt Gap Post Office:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; hard, friable; many fine roots; common fine and very fine pores; common worm casts; few termite tunnels; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

B21t—6 to 16 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; compound moderate, fine and medium, subangular blocky structure and moderate, fine, angular blocky structure; very hard, firm; many fine roots; common fine and very fine pores; common worm casts; common termite tunnels; clay films on most ped faces; few films and threads of calcium carbonate; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—16 to 25 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; compound moderate, fine and medium, subangular blocky structure and moderate, fine, angular blocky structure; very hard, firm; common fine roots; common fine and very fine pores; common worm casts; few termite tunnels; clay films on most ped faces; common films and threads of calcium carbonate; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—25 to 55 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, firm; few fine roots; few worm casts; few thin clay films on ped faces; many calcium carbonate concretions; many soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B24tca—55 to 84 inches reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, firm; few thin clay films on ped faces; common calcium carbonate concretions; many soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Distinct calcic horizons are at depths of 22 to 30 inches. The A horizon and the B21t horizon each range from 5 to 10 inches in thickness and from dark brown to dark grayish brown. The B22t horizon ranges from 6 to 16 inches in thickness and from reddish brown to brown. The Bt horizon is clay loam or clay and has a clay content of 35 to 45 percent. The Btca horizon is reddish yellow or yellowish red. The calcium carbonate equivalent is 40 to 70 percent in the upper part and 20 to 40 percent in the lower part.

Salga clay loam, 0 to 1 percent slopes (ScA).—This soil is on plains and stream terraces. Areas are oblong to irregular in shape and are 20 to 300 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.6 percent.

Included with this soil in mapping are areas of Cho, Karnes, Mereta, Rowena, Sagerton, and Tobosa soils.

Rowena and Sagerton soils are in the same landscape pattern as this Salga soil. The Tobosa soil is in slight depressions a few inches to 2 feet lower than this Salga soil. Mereta, Karnes, and Cho soils are slightly higher on the landscape than this Salga soil. These inclusions are 1 to 5 acres in size.

About 90 percent of the acreage of this Salga soil is cultivated. The remaining 10 percent is used for range. Dryland capability unit IIc–3; irrigated capability unit I–3; Deep Upland range site.

Speck Series

The Speck series consists of shallow, well-drained soils on uplands. These soils formed in loamy materials weathered from limestone. Surfaces are plane to complex, and slopes are 0 to 3 percent.

In a representative profile the surface layer is brown clay loam about 5 inches thick. The next layer is reddish-brown clay about 12 inches thick. Hard limestone is at a depth of about 17 inches.

Internal drainage and permeability are slow. Runoff is medium. The available water capacity is low.

Most of the acreage is used for range. Small acreages in nonstony areas are cultivated.

Representative profile of Speck clay loam, 0 to 3 percent slopes, 16.1 miles north, 5 degrees east of the courthouse in Brady, 1.3 miles southeast of the Bluff Creek Ranch headquarters, 2.4 miles east and 1 mile south of Fife on county road, then 0.8 mile east along private road:

A1—0 to 5 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine and very fine, subangular blocky structure; hard, firm; surface crust one-eighth inch thick; mildly alkaline; clear, smooth boundary.

B2t—5 to 17 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, blocky structure; very hard, very firm; few thin clay films on peds; lower 2 inches is estimated 40 percent hard limestone fragments 1 to 4 inches across long axis and 1 to 2 inches thick; mildly alkaline; abrupt, wavy boundary.

R—17 to 20 inches, limestone bedrock, fractured; few lime coatings in fractures; hardness of more than 3 on Mohs scale.

The solum ranges from 14 to 20 inches in thickness. Reaction throughout the profile is slightly acid to mildly alkaline. Coarse fragments of limestone range from few to about 35 percent in the profile and from few to about 70 percent on the surface. These fragments consist of chert of pebble size and limestone of flag and cobblestone size.

The A horizon ranges from 4 to 6 inches in thickness, from dark grayish brown or brown to dark reddish brown, and from loam to clay loam, exclusive of coarse fragments. The Bt horizon ranges from 10 to 14 inches in thickness and from dark brown to reddish brown. The clay content of the Bt horizon ranges from 45 to about 55 percent. The R layer is marine limestone.

Speck clay loam, 0 to 3 percent slopes (SpB).—This soil is in areas oblong to oval in shape and 10 to 60 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 0.5 to 1.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Kavett, Tarrant, Tobosa, and Valera soils and a soil that is similar to this Speck soil, but is more than 20 inches deep. Tobosa and Valera soils are in oblong areas in natural drainageways. Kavett and Tarrant soils are in oblong to oval areas slightly above this Speck soil. The soil similar to this Speck soil is in weak drainageways or slight depressions. These inclusions are 1 to 5 acres in size and make up less than 10 percent of most areas.

Most of the acreage of this Speck soil is used for range. About 10 to 15 percent is cultivated. Dryland capability unit IIIe–6; Redland range site.

Speck and Tarrant soils, gently undulating (STB).—This mapping unit is in oblong to irregularly shaped areas 20 to 300 acres in size. Surfaces are complex. Slopes are mainly 1 to 2.5 percent, but range from 1 to 3 percent.

This mapping unit is 50 to 75 percent Speck soil, 15 to 35 percent Tarrant soil, and the rest is Kavett, Tobosa, and Valera soils, a nonstony Speck soil, and a soil that is similar to the Speck soil, but is more than 20 inches deep over limestone. The Speck soil occurs in all areas. The Tarrant soil occurs only in some areas.

The Speck soil is less sloping than the other soils in this unit. The Tarrant soil is a few feet above the Speck soil and occurs as bands, in rounded areas, and in crescent-shaped patterns. These soils are mapped as a single unit because they are so intermingled that they could not be shown separately on a map of the scale used.

Limestone gravel, cobblestones, and boulders cover up to 70 percent of the surface area and make up to 35 percent of the soil mass.

The Speck soil has a surface layer of dark grayish-brown clay loam about 5 inches thick. The next layer is reddish-brown clay about 11 inches thick. Hard limestone is at a depth of about 16 inches.

The Tarrant soil has a surface layer of very dark grayish-brown cobbly clay about 8 inches thick and is about 40 percent limestone cobblestones and boulders. The next layer is brown very cobbly clay about 6 inches thick and is about 80 percent limestone fragments. The underlying material is fractured limestone bedrock.

Kavett and the nonstony Speck soils occur as intermingled areas at the same level or slightly below the stony Speck soil. The Tobosa and Valera soils and the soil similar to the Speck soil are in natural drainageways and in the lower areas of the unit. A few short slopes are more than 3 percent. Areas of these soils are 1 to 5 acres in size.

These soils are suited only to range. Dryland capability unit VIs–2; Speck soil in Redland range site, Tarrant soil in Low Stony Hill range site.

Tarrant Series

The Tarrant series consists of nearly level to undulating, very shallow to shallow, well-drained soils that formed in residuum weathered from limestone. These soils are on limestone plateaus bordered by steep breaks. Surfaces are complex, and slopes are mainly 1 to 8 percent.

In a representative profile the surface layer is very dark grayish-brown cobbly clay, about 8 inches thick, and about 40 percent cobblestones and boulders of limestone. The next 6 inches is brown very cobbly clay that is about 80 percent limestone fragments. It is underlain by limestone bedrock.

Permeability is moderately slow. Runoff is rapid. The available water capacity is low.

Tarrant soils are used for range.

Representative profile of Tarrant clay in an area of Tarrant soils, undulating, 9 miles west, 42 degrees south of the courthouse in Brady, in a pasture 100 yards north of pavement, 1.4 miles south of the courthouse on U.S. Highway No. 87, then 8.6 miles southwest on Ranch Road 42:

A11—0 to 8 inches, very dark grayish-brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; compound moderate, very fine, subangular blocky and moderate, fine, granular structure; very hard, firm; many roots; porous peds; few earthworm channels and casts; about 40 percent cobblestones and boulders and 10 percent gravel-size fragments of limestone; pitting on tops and sides of limestone and accumulations of secondary calcium carbonate as pendants and coatings on lower sides; calcareous; moderately alkaline; clear, irregular boundary.

A12ca—8 to 14 inches, brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) moist; compound moderate, very fine, subangular blocky and moderate, very fine, granular structure; very hard, firm; common roots, many of which are matted against rock surface, common pores; about 15 percent, by volume, is vertical and horizontal bands 0.5 inch to 1.5 inches thick; common pores; few earthworm channels and casts; about 80 percent of horizon is cobblestones and boulders of limestone that have coatings and pendants of calcium carbonate; calcareous; moderately alkaline; abrupt, wavy boundary.

R—14 to 32 inches, limestone bedrock that is indurated and fractured, in layers 4 to 30 inches thick; roots in interstices of fractured rock extend to depths of more than 5 feet; few strata of weakly cemented limestone 0.5 inch to 5 inches thick; about 1 to 2 percent dark-brown (10YR 3/3) moist clay 1/32 to 1/2 inch thick in interstices; calcareous and moderately alkaline soil fines.

Depth to bedrock ranges from 6 to 20 inches. Pebbles, cobblestones, and stone-size fragments of limestone make up more than 35 percent of the zone above the bedrock. Limestone fragments on the surface range from 10 to about 60 percent. Reaction ranges from moderately alkaline to neutral. The clay content of the soil ranges from 35 to 60 percent.

The A11 horizon ranges from 4 to 10 inches in thickness; from clay to clay loam, exclusive of coarse fragments; and from brown to very dark grayish brown. The A12 horizon ranges from 2 to 10 inches in thickness and from brown to dark grayish brown. The bedrock is fractured, indurated limestone a few inches to several feet thick. In places it is interbedded with hard limestone and massive pulverulent lime.

Tarrant soils, undulating (TAC).—These gently sloping to undulating soils are on plateaus and breaks. They occur as broad bands and large irregular shaped areas several hundred acres to more than 1,000 acres in size. Surfaces are complex. Slopes generally are 1 to 8 percent, but in some small areas on scarps and breaks they are more than 20 percent. These soils have the profile described as representative for the series.

Areas of Brackett, Dev, Frio, Kavett, Speck, Tobosa, and Valera soils 1 to 25 acres in size make up about 5 to 15 percent of the total acreage. Kavett soils are on the upper parts of shallow valleys and on nearly level plateaus. Brackett soils are on low ridges, knobs, and short scarps in areas that range from irregular in shape to long and narrow bands. These areas are mainly along the fringe of Tarrant soils. Valera soils are oblong to oval areas in shallow valleys. Tobosa soils are in low-lying areas. Speck soils are intermingled with Tarrant soils. Frio and Dev soils occur as narrow bands in natural drainageways.

The entire acreage of these Tarrant soils is used for range. Dryland capability unit VIs–1; Low Stony Hill range site.

Tarrant-Kavett association, undulating (TKC).—This mapping unit is on upland plateaus commonly bordered by short, steep scarps. It is about 50 percent Tarrant soil, 45 percent Kavett soil, and 5 percent Brackett, Randall, Speck, Tobosa, and Valera soils. Areas are oblong to irregular in shape and generally are several hundred acres in size. Surfaces are complex.

The Tarrant soil occupies most of the ridges and plateaus. Slopes are dominantly 2 to 8 percent, but on some short scarps they are more than 8 percent.

The Kavett soil forms irregularly shaped bands, 50 to 100 yards wide and several hundred yards long, on sides of ridges and in shallow valleys. Slopes are 1.5 to 5 percent.

The Tarrant soil has a surface layer of dark grayish-brown cobbly clay, about 8 inches thick, that is about 40 percent cobblestones and boulders of limestone. The next layer is brown very cobbly clay, about 6 inches thick, that is about 80 percent limestone fragments. The underlying material is fractured limestone bedrock.

The Kavett soil has a surface layer of dark grayish-brown silty clay about 8 inches thick. The next layer is brown silty clay about 8 inches thick. The underlying material is caliche-coated limestone.

Randall, Tobosa, and Valera soils are in small valleys and in the lower parts of natural drainageways. The Speck soil is in isolated spots in about the same position as the Kavett soil. The Brackett soil is on short, steep scarps. Areas of these less extensive soils are 1 to 10 acres in size.

The entire acreage is used for range. Dryland capability unit VIs–1; Tarrant soil in Low Stony Hill range site, Kavett soil in Shallow range site.

Tobosa Series

The Tobosa series consists of deep, moderately well drained soils on uplands. These soils formed in calcareous, clayey, old alluvial deposits and residuum derived from limestone and shale. They crack if they are dry. Surfaces are plane to weakly concave, and slopes are 0 to 3 percent.

In a representative profile the surface layer is dark grayish-brown clay about 28 inches thick. The next layer is brown clay about 30 inches thick. The underlying material is light-brown clay that has a weak lime accumulation.

Gilgai microrelief, under native conditions, is destroyed under cultivation. If these soils are dry, they crack to a depth of more than 30 inches, and water enters the soil rapidly. If these soils are wet, the cracks close, and water movement into the soil is very slow. Permeability is very slow. Runoff is medium. The available water capacity is high.

Most of the acreage of Tobosa soils is used for range. The rest is cultivated.

Representative profile of Tobosa clay, 0 to 1 percent slopes, 3.8 miles west and 7 degrees south of the courthouse in Brady, 0.5 mile north-northeast of and 0.4 mile northwest of Farm Road 2028, 1.1 miles south of the courthouse on U.S. Highway No. 377, then 4 miles west on Farm Road 2028; 1 mile southwest of the Brady Reservoir principal spillway:

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, very fine, subangular blocky and granular structure; hard, firm; common roots, few chert and quartz grains; calcareous; moderately alkaline; clear, wavy boundary.

A12—7 to 28 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, angular blocky structure; very hard, very firm; few roots; slickensides are well formed and tilt at 30° to 60° from horizontal; vertical and slanted cracks up to one-half inch across extend to a depth of more than 20 inches; wedge-shaped peds; few angular and subrounded chert and quartz grains up to one-fourth inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

AC—28 to 58 inches, brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate, fine and very fine, angular blocky structure; very hard, very firm; slickensides are well formed and intersect; dark soil from horizon above has filled cracks one-fourth inch wide; few chert and quartz grains up to 3 millimeters in diameter; few lime concretions; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—58 to 80 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; massive; very hard, firm; about 3 percent is calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 41 to 60 inches in thickness. The clay content ranges from 45 to 60 percent.

The A horizon ranges from 18 to 32 inches in thickness and from brown or dark grayish brown to very dark grayish brown. The AC horizon ranges from 16 to 32 inches in thickness and from brown to grayish brown. The C horizon is brown or light-brown to very pale brown clayey earth that in places is as much as 20 percent lime concretions. The C horizon is thin or lacking in some profiles, and the soil is underlain by limestone, shale, or a IIC horizon of loamy alluvium.

Tobosa clay, 0 to 1 percent slopes (ToA).—This soil is in areas oblong, oval, and elongated in shape and 10 to about 300 acres in size. Surfaces are plane to weakly concave, and slopes are dominantly 0.2 to 0.5 percent. This soil is a few inches to a few feet lower than surrounding soils. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Kavett, Mereta, Rowena, Salga, and Valera soils. These inclusions are oblong to elongated, are at the outer edge of mapped areas, and are slightly higher on the landscape than Tobosa soils. The inclusions are 1 to 5 acres in size and make up less than 10 percent of the total acreage.

About half or more of the acreage of this Tobosa soil is cultivated. The rest is used for range. Dryland capability unit IIs–2; irrigated capability unit IIs–2; Deep Upland range site.

Tobosa clay, 1 to 3 percent slopes (ToB).—This soil is in areas oblong to elongated in shape and 10 to about 350 acres in size. Surfaces are plane to concave, and slopes are dominantly 1.5 to 2 percent. The surface layer is brown clay about 26 inches thick. The next layer is brown clay about 30 inches thick. The underlying material is light-brown clay. Sheet erosion is evident in local spots of less than 5 acres, and a few, shallow, broad gullies have formed.

Included with this soil in mapping are areas of Kavett, Mareta, Nuvalde, Salga, and Valera soils. These inclusions are oval to elongated areas 1 to 5 acres in size and are mostly at the outer edges and slightly above Tobosa soils. These inclusions make up no more than 10 percent of any one area.

About 30 percent of the acreage of this Tobosa soil is cultivated. The rest is used for range. Dryland capability unit IIIe–2; irrigated capability unit IIIe–1; Deep Upland range site.

Valera Series

The Valera series consists of well-drained, moderately deep soils on uplands. These soils formed in clayey materials derived from limestone. Surfaces are plane to complex, and slopes are 1 to 3 percent.

In a representative profile the surface layer is dark grayish-brown clay about 20 inches thick. The next layer is brown clay about 13 inches thick. The underlying material is indurated caliche and limestone.

Permeability is moderately slow. Surface runoff is slow to medium. The available water capacity is high. Tilth is maintained without difficulty. If these soils are dry, they crack to a depth of at least 20 inches.

Most of the acreage of Valera soils is in range, and some areas are cultivated.

Representative profile of Valera clay, 1 to 3 percent slopes, 14.5 miles south, 71 degrees west of the courthouse in Brady, or 1.8 miles south of right angle turn in county road, 1.1 miles south of the courthouse on U.S. Highway No. 87, then 14 miles west on Farm Road 2028. then 1.5 miles south on county road:

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

A12—10 to 20 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, angular blocky structure; hard, firm; calcareous; moderately alkaline; gradual, smooth boundary.

B2—20 to 33 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, fine and very fine, angular blocky structure; very hard, very firm; shiny faces on peds; few fine limestone fragments 1 to 5 millimeters in diameter; few worm casts; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—33 to 36 inches, pinkish-white (5YR 8/2) indurated calcium carbonate; few brown clay coatings in partings; about 10 percent limestone fragments up to 19 millimeters in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

R—36 to 37 inches, fractured hard limestone; caliche coatings on limestone and in fractures.

The solum ranges from 22 to 40 inches in thickness. The clay content ranges from 40 to 55 percent.

The A horizon ranges from 10 to 20 inches in thickness and from brown to dark grayish brown. The B horizon ranges from 12 to 18 inches in thickness and from brown to reddish brown. The Cca horizon ranges from cemented caliche that coats the underlying limestone to a layer of limy earth, up to 12 inches thick, that has a strongly cemented and platy

caliche layer in the upper 2 to 4 inches. It ranges from brown to white or pink.

Valera clay, 1 to 3 percent slopes (VaB).—This soil is in valleys and on plateaus. Areas are oblong to irregular in shape and are 10 to about 150 acres in size. Surfaces are plane to complex, and slopes are dominantly 1.5 to 2 percent.

Included with this soil in mapping are areas of Kavett, Rowena, Speck, Tarrant, and Tobosa soils, and a soil that is similar to Speck soils, but is more than 20 inches deep. The Tobosa soil occupies areas in the lower part of natural drainageways. The Kavett and Speck soils and the soil similar to the Speck soil are in areas at the upper levels of the mapping unit. Rowena soils are on side slopes along transitional areas between limestone hills and areas of old alluvial soils. Tarrant soils are on low isolated knobs and ridges above Valera soils. These inclusions are 1 to 5 acres in size and make up no more than 10 percent of the total acreage.

About one-third of the acreage of this Valera soil is cultivated. The rest is used for range. Dryland capability unit IIe–3; irrigated capability unit IIe–4; Deep Upland range site.

Voca Series, Moderately Shallow Variant

The Voca series, moderately shallow variant, consists of moderately deep, well-drained soils on low ridges of uplands. These soils formed in loamy materials weathered from granite. Slopes are complex and range from 1 to 5 percent.

In a representative profile the surface layer is fine sandy loam about 14 inches thick. It is brown in the upper part and reddish brown in the lower part. The next layer is yellowish-red gravelly sandy clay about 10 inches thick. The underlying material is pinkish gneiss that is partly weathered.

Runoff and internal drainage are medium. Permeability is slow, and the available water capacity is low.

Most areas of these soils are used for range. A few are used for crops.

Representative profile of Voca fine sandy loam, moderately shallow variant, 1 to 5 percent slopes, 15.8 miles south and 44 degrees east of the courthouse in Brady, 33 feet west of a field fence, 0.5 mile north of the Mason County line marker on Texas Highway No. 71, then 0.5 mile west on private road to cattle guard, then 660 feet north along field fence:

Ap—0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable; many roots; surface crust crushes easily; estimated 3 percent is quartz and feldspar fragments 3 to 5 millimeters in diameter; neutral; abrupt, smooth boundary.

A1—6 to 14 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; coarse prismatic structure parting to moderate, very fine, subangular blocky structure; very hard, friable; many roots; many pores; few worm casts; about 5 percent is quartz and feldspar fragments 3 to 5 millimeters in diameter; slightly acid; clear, wavy boundary.

B2t—14 to 24 inches, yellowish-red (5YR 5/6) gravelly sandy clay, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure parting to very fine angular structure and some subangular blocky structure; very hard, firm; few fine pores; few thin clay films on peds; estimated 20 to 30 percent is coarse fragments of quartz and feldspar up to one-half inch in diameter; slightly acid; gradual, wavy boundary.

R—24 to 40 inches, pinkish gneiss, partly weathered in upper 6 inches and about 10 percent sandy clay similar to that in the B2t horizon in interstices; very hard and massive below.

The solum is 24 to 40 inches thick. Coarse fragments of quartz and feldspar range from few to about 30 percent throughout the solum. Base saturation of the soil ranges from 50 to 75 percent. The clay content in the Bt horizon ranges from 35 to about 42 percent. Veins of schistose gneiss and quartz a few feet to 30 yards wide that have outcrops of cobblestones and boulders occur in places on the crests of ridges.

The A horizon ranges from 10 to 18 inches in thickness and from brown to reddish brown. The B horizon ranges from 10 to 15 inches in thickness and from gravelly clay loam to gravelly sandy clay and from clay loam to sandy clay. It ranges from reddish brown to yellowish red. The R horizon ranges from weakly cemented to strongly cemented gneiss. The upper few inches generally is weathered and is up to about 10 percent of sandy clay in the interstices.

Voca fine sandy loam, moderately shallow variant, 1 to 5 percent slopes (VoC).—This soil is on low oval-shaped ridgetops. Areas are oblong, oval, and irregular in shape and are 20 to 50 acres in size. Slopes are complex.

A few eroded spots, 1 to 3 acres in size, occur in cultivated fields. The plow layer has windrowed to fine sand in some places. Coarse fragments, mostly quartz and some schistose gneiss, cause some difficulty in cultivating this soil. Quartz dikes are 2 to 5 feet wide and several yards long, and schistose gneiss outcrops are up to 20 feet wide on the crests of ridges.

Included with this soil in mapping are small areas of Demona and Cobb soils. Demona soils are in drainageways, and Cobb soils are near the base of slopes bordering sandstone areas. These inclusions are less than 5 acres in size and make up less than 15 percent of the total acreage.

About half the acreage of this Voca soil was cultivated. All but about 5 to 10 percent is now idle or has been returned to grazing land. Dryland capability unit IIIe–3; irrigated capability unit IIIe–2; Sandy Loam range site.

Voca Series

The Voca series consists of moderately deep to deep, well-drained soils on uplands. These soils formed in loamy materials weathered from granite. Surfaces are complex. Slopes are mainly less than 5 percent but range from 0 to 12 percent. The landscape is well dissected by drainageways. Outcrops of granite boulders and quartz likes are common where slopes are more than 3 percent.

In a representative profile the surface layer is brown gravelly sandy loam about 5 inches thick (fig. 18). The next 4 inches is light-brown gravelly sandy loam. Below this is gravelly clay about 39 inches thick. It is dark red in the upper part and reddish brown in the lower part. The underlying material is pinkish, fragmented granite.

Permeability is slow. Runoff and internal drainage are medium. The available water capacity is low.

Voca soils are used mostly for range. A few areas are cultivated.

Representative profile of Voca gravelly sandy loam, 0 to 3 percent slopes, 15.4 miles south, 34 degrees east of

Figure 18.—Profile of Voca gravelly sandy loam, 0 to 3 percent slopes.

the courthouse in Brady, or 10 yards north of private road, 4.3 miles south of Voca on Ranch Road 1851, then 480 yards west on private road:

A1—0 to 5 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, very friable; many fine roots; common very fine pores; estimated 25 percent is fine granite fragments; neutral; clear, smooth boundary.

A2—5 to 9 inches, light-brown (7.5YR 6/4) gravelly sandy loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; hard, very friable; many fine roots; many very fine pores; estimated 25 percent is fine granite fragments; neutral; abrupt, smooth boundary.

B21t—9 to 30 inches, dark-red (2.5YR 3/6) gravelly clay, dark red (2.5YR 3/6) moist; moderate, fine, angular and subangular blocky structure; very hard, firm; few fine roots; few very fine pores; estimated 30 percent is fine granite fragments; common distinct clay films on peds; few shiny flakes of feldspar and mica; slightly acid; gradual, wavy boundary.

B22t—30 to 48 inches, reddish-brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) moist; moderate, fine, subangular blocky structure; very hard, firm; few roots; clay films on peds; many shiny flakes of feldspar and mica; estimated 50 percent is fine granite fragments; slightly acid; gradual, wavy boundary.

R—48 to 60 inches, estimated 80 to 90 percent pinkish, fragmented granite that has thin films of soil material from horizon above and many mica flakes; slightly acid.

The solum ranges from 36 to 60 inches in thickness. Coarse granite fragments, mostly quartz and feldspar, make up about 10 to 30 percent of the A horizon and 25 to 35 percent of the upper 20 inches of the Bt horizon. The content of coarse fragments increases with depth. Reaction in the A horizon is neutral or slightly acid.

The A1 horizon ranges from 3 to 8 inches in thickness and from brown or yellowish brown to dark brown. The A2 horizon ranges from 3 to 12 inches in thickness and from light brown or very pale brown to dark brown. The B2t horizon ranges from gravelly clay to gravelly sandy clay and has a clay content of 45 to 60 percent. The B21t horizon ranges from 10 to 25 inches in thickness and from yellowish red to dark red. The B22t horizon ranges from 8 to 20 inches in thickness and from reddish brown to yellowish red. The content of coarse fragments in the B22t horizon ranges from 25 to 70 percent.

Voca gravelly sandy loam, 0 to 3 percent slopes (VsB).—This soil is in areas oblong to irregular in shape and 20 to more than 500 acres in size. Surfaces are complex, and slopes are dominantly 0.2 to 2.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Blanket, Cobb, Demona, and Tobosa soils, and a soil that is similar to this Voca soil, but is less clayey in the underlying layers. Blanket and Tobosa soils are in the upper part of natural drainageways. The Tobosa soil is in slight depressions. Cobb and Demona soils are on side slopes and along natural drainageways near the outer edges of the mapping unit. The soil similar to this Voca soil is on the crests of low, weakly convex ridges. These inclusions are 1 to 5 acres in size and make up less than 10 percent of the total acreage.

This Voca soil is used for range. A few acres are cultivated, but most cropland is being converted to grazing land. Dryland capability unit IVs–1; Granite Gravel range site.

Voca gravelly sandy loam, 3 to 12 percent slopes, severely eroded (VsD3).—This soil is on short sides of numerous gullies, in partly filled drainageways, and on some narrow foot slopes that receive deposits from the downward movement of soil. Areas are oblong to irregular in shape and are 20 to about 500 acres in size. Slopes are typically 4 to about 10 percent, but on some short gully walls they are more than 20 percent. Gullies are about one-fourth mile to three-fourths of a mile long, are generally 75 to 100 yards apart, and lead to a single major drainageway. Deeply incised, short, V-type gullies are numerous and form lateral drainageways along longer gullies. They have cut 5 to 10 feet below the gently sloping Voca soils.

This Voca soil has a surface layer of yellowish-brown gravelly sandy loam about 4 inches thick. The next layer is very pale brown gravelly sandy loam about 6 inches thick. Below this is yellowish-red gravelly clay about 30 inches thick. The underlying material is pinkish, fractured granite.

Erosion has affected about 90 percent of the acreage. Gullies have cut into the lower layers in about 25 to 30 percent of the mapped areas. Where the lower layers are not eroded, they are the same as those typical of the series, but thinner. Colluvial deposits of sandy loam occur at the base of some slopes. Weathered granite is exposed in the lower part of most gullies. Outcrops of huge, rounded granite boulders that occur singly or in clusters are common and make up about 10 percent of the mapping unit.

Included with this soil in mapping are areas of Ligon soils that are on the crests of ridges near slope breaks near the edge of the mapping unit. They occur as narrow bands and isolated areas oblong in shape and 1 to about 5 acres in size. These inclusions make up about 10 percent of the total acreage.

This Voca soil is better suited to range than other uses. Dryland capability unit VIe–1; Granite Gravel range site.

Yahola Series

The Yahola series consists of deep, well-drained soils on flood plains. These soils formed in alluvial sediments. Surfaces are convex, and slopes are 0 to 3 percent in infrequently flooded areas. Surfaces are complex, and slopes are 3 to 16 percent on first bottoms, which are subject to frequent flooding.

In a representative profile reddish-brown fine sandy loam extends to a depth of about 42 inches. The next layer is a yellowish-red loam about 10 inches thick. It is underlain by reddish-yellow fine sandy loam.

Permeability is moderately rapid. Runoff is slow. The available water capacity is high.

Yahola soils are used for crops and range.

Representative profile of Yahola fine sandy loam, 21.4 miles north, 30 degrees west of the courthouse in Brady, in a cultivated field 0.4 mile northeast from the southwest corner of a field, 3 miles west of the intersection of U.S. Highway No. 283 and Farm Road 765 near Fife, then 1 mile north and 0.2 mile west on county road to ranchhouse, then 1.2 miles north along pasture trail:

Ap—0 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, very fine, granular structure; soft, very friable; weak surface crust breaks easily; calcareous; moderately alkaline; clear, wavy boundary.

C1—10 to 42 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable; many pores; few fine shell fragments; thin strata of silt loam and loamy fine sand in lower part; few bedding planes; few uneven or spotted dark colorings of organic matter; calcareous; moderately alkaline; gradual, wavy boundary.

C2—42 to 52 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; many pores; grayish-brown uneven staining of organic matter; few fine shell fragments; thin strata of silt loam and loamy fine sand; few bedding planes; calcareous; moderately alkaline; gradual, wavy boundary.

C3—52 to 65 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; many pores; strata of loamy fine sand ⅛ to ¼ inch thick; few small shell fragments; calcareous; moderately alkaline.

This soil is stratified throughout. The A horizon ranges from 6 to 20 inches in thickness and is mostly fine sandy loam, but thin strata of loam, loamy fine sand, and silt loam are common. The A horizon ranges from reddish brown to light brown. The C horizon ranges from yellowish red, reddish yellow, or light brown to reddish brown. The upper part of the C horizon is 5 to 18 percent clay by weight. It is dominantly fine sandy loam but ranges to loamy very fine sand. Stratification with finer or coarser textured material is common.

Yahola fine sandy loam (Ya).—This nearly level to gently sloping soil is in oblong-shaped areas that are 10 to about 100 acres in size and are oriented with streamflow. Surfaces are weakly convex. Slopes are 0 to 3 percent, but are dominantly 0.5 to 2 percent. Flooding occurs at intervals of about once in 30 years. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Clairemont and Miller soils and low-lying areas of more frequently flooded soils that are stratified with silty clay loam to coarse sand. Also included are a few gully walls and short, steep scarps where slopes are more than 3 percent. Clairemont and Miller soils are lower on the landscape than Yahola soils. Clairemont soils are in oblong-shaped areas and are adjacent to Yahola soils. Miller soils are in elongated natural drainageways near upland foot slopes and parallel streamflow. These inclusions are 1 to 5 acres in size.

Most of the acreage of this Yahola soil is cultivated. Dryland capability unit IIe–4; irrigated capability unit IIe–5; Loamy Bottomland range site.

Yahola soils, strongly sloping (YHD).—This mapping unit is about 55 percent Yahola soils and 45 percent a soil similar to Yahola soils, Clairemont soils, and other soils. The landscape is a succession of slopes and benches. Areas range from about 30 to several hundred acres in size; are about 500 feet wide, but range from 100 to 1,200 feet; and are oblong to elongated in shape. They form a nearly continuous band along the river and extend for short distances up most tributaries. Slopes are 8 to 16 percent, but generally are 12 to 16 percent. Elevation from the river channel to the highest levels ranges from 30 to 80 feet and averages 50 to 60 feet. This rise in elevation typically has two or more steps and one or more benches. The mapping unit is well dissected by short drainageways and broken at intervals by major tributaries to the river.

This Yahola soil has a surface layer of reddish-brown fine sandy loam about 38 inches thick. The next layer is light-brown loam about 15 inches thick. Below this is reddish-yellow fine sandy loam.

Yahola soils are dominant on the lower lying benches and steps. Clairemont soils are dominant in the upper areas. Frequently flooded Yahola soils and a soil that is similar to Yahola soils, but has lower layers of loamy fine sand, are near the river on undulating, low-lying benches. They are subject to deposition and removal of

sediments with each flooding. In a few low-lying areas on the flood plains are soils that are similar to Clairemont soils, but are more clayey below the surface layer. Other soils occupy small areas just below terraces. They occur as bands about 150 yards wide and 300 yards long.

This mapping unit is used for range. The low-lying areas are flooded once or more each year and higher lying areas at less frequent intervals. Erosion in overfall gullies is a concern in some places. Dryland capability unit VIe–2; River Breaks range site.

Yates Series

The Yates series consists of well-drained, very shallow soils on uplands. These soils formed in loamy materials derived from limestone. Surfaces are convex to plane, and slopes are 1 to 8 percent.

In a representative profile the surface layer is reddish-brown fine sandy loam about 6 inches thick. It is underlain by indurated, fractured limestone.

Permeability is moderate. Internal drainage is medium. Surface runoff is medium to rapid. The available water capacity is low.

Yates soils are used for range.

Representative profile of Yates stony fine sandy loam in an area of Yates association, undulating, 11.4 miles south, 51 degrees east of the courthouse in Brady, in pasture 75 feet east of country road, 4.1 miles south of the courthouse on U.S. Highway No. 377, then 7.5 miles southeast on Texas Highway No. 71, then 2 miles east and 0.2 mile north on Long Valley Road:

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; hard, friable; common roots; about 30 percent of the surface is covered with nearly flat-lying rust-brown limestone flags 1 to 6 inches thick and up to 4 feet across the long axis; about 45 percent of the soil is limestone flags of same size as on surface and common fragments less than 3 inches in diameter; mildly alkaline; abrupt, smooth boundary.

R—6 to 60 inches, indurated, coarsely fractured limestone, mostly 1 to 6 inches thick and up to 10 feet along the long axis, and common fragments less than 3 inches in diameter.

The solum ranges from 5 to 10 inches in thickness, from fine sandy loam to loam, and from reddish brown to brown. Coarse fragments make up 35 to 85 percent of the A horizon and cover 10 to 75 percent of the surface area. Reaction is neutral to mildly alkaline. Some areas are calcareous. The R horizon is layered, coarsely fractured limestone several feet thick. Thin caliche coatings are in vertical fractures and on the underside of the limestone in some areas.

Yates association, undulating (YTC).—This mapping unit is on the tops and sides of ridges. Areas are oblong in shape and several hundred acres in size. Surfaces are convex to plane. Slopes are dominantly 3 to 8 percent, but range from 1 to 12 percent.

Areas, 1 to 10 acres in size, of Pontotoc and Tarrant soils, a soil that is similar to Cobb soils and overlies limestone, loamy colluvial deposits along the base of steep slopes, and outcrops of fractured sandstone on short steep scarps make up as much as 10 percent of the total acreage. Pontotoc soils occur as bands below the base of sandstone scarps and in the lower part of natural drainageways. Areas of Tarrant soils are oblong to oval in shape and are on ridge crests that have weakly convex surfaces. The soil similar to Cobb soils is in areas where surfaces are weakly concave. The colluvial deposits occur as elongated bands about 75 yards wide and up to 400 yards long. The sandstone scarps are 50 to 150 yards wide and up to a half mile long.

These soils are used for range. Dryland capability unit VIIs–2; Stony Loam range site.

Use and Management of the Soils

This section describes the use of the soils, their limitations, and management needs. The capability grouping is explained, and the soils of the county are grouped according to their suitability for crops and other uses. Predicted yields of the major crops are shown in table 2.

Managing Soils for Crops

In McCulloch County management is needed mainly for controlling erosion, conserving moisture, and maintaining fertility and tilth. The main practices used to accomplish these purposes are described in the following paragraphs.

Crop residue.—A sufficient amount of residue left on the soil helps to control erosion and conserve moisture. If this residue is plowed under, it helps to maintain or improve soil tilth.

Contour terraces.—If terraces are farmed on the contour, they help to control water erosion. In McCulloch County level terraces that have closed ends are used to conserve water.

Cover crops.—Cover crops furnish protective cover during seasons of high-intensity rainfall. Small grain as a part of the cropping system is the chief cover crop. Legumes and small grain provide protection against soil blowing on soils that have a sandy surface layer. Critical periods of erosion extend from March to May and from September to November.

Soil fertility.—If soil moisture is sufficient, crops respond to additions of fertilizer. Because rainfall is limited and drought is frequent, commercial fertilizer is used in limited amounts in dryland farming. If moisture is adequate, the use of fertilizer is economical on most soils under dryland farming. Under irrigation, fertilizer is needed to maintain adequate crop production. If other good practices of soil management are used and proper amounts of fertilizer are applied, fertility can be maintained. Information on soil testing and application of fertilizers can be obtained from the Soil Conservation Service or the Agricultural Extension Service.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when 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 char-

acteristics 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 requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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, require special conservation practices, or both.

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

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in McCulloch County.)

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

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units generally are designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages the capability units in McCulloch County are described and suggestions for the use and management of the soils are given. All the soils in the county were assigned dryland capability units, but only those soils normally irrigated were assigned to irrigated units. Both kinds of units are described on the following pages.

IRRIGATED CAPABILITY UNIT I–1

The one soil in this unit, Pedernales fine sandy loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderately slow. The available water capacity is high.

This soil is well suited to grain sorghum, cotton, and small grain.

Maintaining or improving productivity and tilth are the main concerns of management. Crusting of the surface after rains can inhibit the emergence of young seedlings. A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue.

Incorporating residue into the soil helps to improve or maintain tilth.

IRRIGATED CAPABILITY UNIT I–2

The one soil in this unit, Sagerton clay loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderately slow. The available water capacity is high. Clayey layers within the soil restrict the movement of water and plant roots.

Grain sorghum, cotton, and small grain are the crops most commonly grown.

Crops that produce high residue, such as grain sorghum, are needed in the crop rotation. Incorporating residue into the soil helps to maintain or improve tilth.

IRRIGATED CAPABILITY UNIT I–3

The one soil in this unit, Salga clay loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderate, and the available water capacity is high.

Cultivated crops are grain sorghum, cotton, and small grain.

Maintaining or improving tilth and conserving moisture are the main concerns of management. A cropping system that returns large amounts of residue to the soil

is needed. Examples of such crops are grain sorghum and small grain.

IRRIGATED CAPABILITY UNIT I-4

The one soil in this unit is Frio clay loam. It is a deep, well-drained, nearly level soil on flood plains. It is flooded at intervals of 15 to 30 years. Permeability is moderately slow. The available water capacity is high.

Grain sorghum, cotton, and small grain are the chief crops.

A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue. Incorporating residue into the soil helps to conserve moisture and maintain or improve tilth. A cover crop is needed to help control scouring when the soil is flooded.

IRRIGATED CAPABILITY UNIT I-5

This unit consists of deep, nearly level, well-drained soils on flood plains. Permeability is moderate, and the available water capacity is high. Flooding occurs at intervals of once in 20 to 30 years.

Small grain and grain sorghum are the main crops.

Cropping systems designed to leave large amounts of residue are needed to help maintain or improve tilth. Grain sorghum, for example, produces a large amount of residue. A cover crop is needed to help control scouring when the soils are flooded.

IRRIGATED CAPABILITY UNIT IIe-1

This unit consists of moderately deep to deep, well-drained, gently sloping soils on uplands. Permeability is moderate. The available water capacity is high. The erosion hazard is moderate.

These soils are well suited to cultivated crops and are easily worked. Grain sorghum, small grain, cotton, and peanuts are the main crops.

Controlling erosion and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue. Contour farming and terracing are needed to help control water erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIe-2

This unit consists of deep, well-drained, gently sloping soils on uplands. Permeability is moderately slow. The available water capacity is high. The hazard of erosion is moderate.

These soils are well suited to small grain, cotton, and grain sorghum.

A suitable cropping system includes high residue-producing crops. Incorporating large amounts of residue into the soil helps to maintain or improve tilth. Terracing and contour farming are needed to help control erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIe-3

The one soil in this unit is Nuvalde clay loam, 1 to 3 percent slopes. It is a gently sloping, well-drained soil on uplands. Permeability is moderate. The available water capacity is high. The erosion hazard is moderate.

This soil is suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Maintaining or improving tilth and controlling erosion are the main concerns of management. A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue. Incorporating residue into the soil helps to improve or maintain tilth. Terracing and contour farming are needed to help control erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIe-4

This unit consists of moderately deep to deep, well-drained, gently sloping soils on uplands. Permeability is moderately slow. The available water capacity is high. The erosion hazard is moderate.

These soils are well suited to cultivated crops. Cotton, grain sorghum, and small grain are the main crops.

Maintaining or improving tilth and controlling erosion are the main concerns of management. A suitable cropping system includes crops that produce a large amount of residue. Incorporating residue into the soil helps to maintain or improve tilth. Terracing and contour farming are needed to help control erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIe-5

The one soil in this unit is Yahola fine sandy loam. It is a deep, well-drained, nearly level to gently sloping soil on bottom lands. The available water capacity is high. Permeability is moderately rapid. This soil is subject to flooding at intervals of about 30 years.

This soil is suitable for cultivation. Small grain and grain sorghum are the main crops.

Maintaining or improving tilth is an important concern of management. Crusting of the surface after rains can inhibit the emergence of young seedlings. Incorporating a large amount of residue into the soil helps to reduce surface crusting.

IRRIGATED CAPABILITY UNIT IIe-6

The one soil in this unit, Pedernales fine sandy loam, 1 to 3 percent slopes, is a deep, well-drained, gently sloping soil on uplands. Permeability is moderately slow. The available water capacity is high. The erosion hazard is moderate.

This soil is well suited to cultivated crops. Grain sorghum, cotton, and small grain are the main crops.

Maintaining or improving tilth and controlling erosion are the main concerns of management. A suitable cropping system includes crops that produce a large amount of residue. Contour farming and terracing are needed to help control erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIs-1

The one soil in this unit, Miller silty clay, is a deep, moderately well drained, nearly level soil on bottom lands. Permeability is very slow. The available water capacity is high. This soil cracks when dry. Flooding is at intervals of once in 30 years.

This soil is suitable for cultivation. Small grain, cotton, and grain sorghum are the main crops.

Crusting of the surface after rains can inhibit the emergence of young seedlings. Incorporating a large amount of residue into the soil helps to maintain or improve tilth and reduces surface crusting.

IRRIGATED CAPABILITY UNIT IIs-2

This unit consists of deep, nearly level, well-drained to somewhat poorly drained soils on uplands. Permeability is very slow. The available water capacity is high. These soils are somewhat difficult to work. Seasonal ponding occurs on a few acres in slight depressions during years of above-average rainfall.

Most of the acreage is cultivated. Small grain, grain sorghum, and cotton are the main crops.

Tilth is more easily maintained if a large amount of crop residue is incorporated into the soil at regular intervals. Terracing helps in draining the slight depressions where seasonal ponding occurs.

IRRIGATED CAPABILITY UNIT IIs-3

The one soil in this unit is Rowena clay loam, 0 to 1 percent slopes. It is a well-drained, nearly level soil on uplands. It is moderately deep over caliche. Permeability is moderately slow. The available water capacity is high.

This soil is suited to large-scale farming. Grain sorghum, cotton, and small grain are the main crops.

Maintaining or improving tilth is the main concern of management. A suitable cropping system includes grain sorghum, small grain, or other crops that produce a large amount of residue.

IRRIGATED CAPABILITY UNIT IIIe-1

This unit consists of deep, well drained to moderately well drained, gently sloping soils on uplands. The available water capacity is high. The erosion hazard is slight to moderate.

Controlling erosion, conserving moisture, and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue. Contour farming and terracing are needed to help control erosion and conserve moisture.

IRRIGATED CAPABILITY UNIT IIIe-2

This unit consists of moderately deep to deep, gently sloping soils on uplands. Permeability is moderate to slow. The available water capacity is low to moderate. The erosion hazard is moderate.

These soils are suitable for cultivation, but occur only as small areas and are therefore not suitable for large-scale farming. Small grain and grain sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining or improving tilth are the main concerns of management in cultivated areas. A suitable cropping system includes crops that contribute a large amount of residue to the soil. Winter cover crops help to control erosion during critical periods.

IRRIGATED CAPABILITY UNIT IIIe-3

The one soil in this unit, Demona loamy sand, 0 to 3 percent slopes, is a deep, moderately well drained soil on uplands. Permeability is moderately slow. The available water capacity is moderate.

Most of the acreage is cultivated. Peanuts is the main crop. Small acreages are used for grain sorghum, oats, and improved pasture.

Conserving moisture and controlling soil blowing are the main concerns of management. Incorporating a large amount of residue into the soil helps to control soil blowing and conserves moisture. Winter cover crops help to control erosion during critical periods.

IRRIGATED CAPABILITY UNIT IVe-1

The one soil in this unit is Acove fine sandy loam, 1 to 5 percent slopes. It is a moderately deep, well-drained, gently sloping soil on uplands. Permeability is moderately slow. The available water capacity is low.

This soil is suitable for cultivation. Peanuts is the main crop. Small acreages are cultivated to grain sorghum and oats.

Controlling erosion and maintaining or improving tilth are the main concerns of management. A cropping system that provides a large amount of crop residue is needed. Incorporating residue on the surface and farming on the contour help to control erosion and to maintain or improve tilth.

DRYLAND CAPABILITY UNIT IIe-1

This unit consists of moderately deep to deep, well-drained, gently sloping soils on uplands. Permeability is moderate. The available water capacity is moderate to high. The erosion hazard is moderate.

These soils are suitable for cultivation. Small grain, grain sorghum, cotton, and peanuts are the main crops.

Maintaining or improving tilth and controlling erosion are the main concerns of management. A cropping system that contributes a large amount of residue to the soil is needed. Terracing and contour farming are needed to help control erosion and conserve moisture.

DRYLAND CAPABILITY UNIT IIe-2

This unit consists of deep, well-drained, gently sloping soils on uplands. Permeability is moderately slow. The available water capacity is high. The erosion hazard is moderate.

These soils are suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Controlling erosion, conserving moisture, and maintaining or improving tilth are the main concerns of management. Terracing and contour farming are needed to control runoff and erosion and conserve moisture. A cropping system that provides for the incorporation of a large amount of residue into the soil is needed. Managing crop residue on the surface helps to improve soil tilth.

DRYLAND CAPABILITY UNIT IIe-3

This unit consists of moderately deep to deep, well-drained, gently sloping soils on uplands. Permeability is moderate to moderately slow. The available water capacity is high. The erosion hazard is moderate.

These soils are suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Conserving moisture, controlling runoff and erosion, and maintaining or improving tilth are the main concerns of management. Terracing, contour farming, and using a cropping system that contributes a large amount of crop residue to the soil are needed.

DRYLAND CAPABILITY UNIT IIe-4

The one soil in this unit is Yahola fine sandy loam. It is a deep, well-drained, nearly level to gently sloping soil

on bottom lands. Permeability is moderately rapid. The available water capacity is high. This soil is subject to flooding at intervals of once in about 30 years.

This soil is suitable for cultivation. Small grain and grain sorghum are the main crops.

Maintaining or improving tilth is the main concern of management. Crusting of the surface after rains can inhibit the emergence of young seedlings. Large amounts of crop residue managed on the surface help to reduce the effects of surface crusting.

DRYLAND CAPABILITY UNIT IIs–1

The one soil in this unit is Miller silty clay. It is a deep, nearly level, moderately well drained soil on bottom lands. Permeability is very slow. The available water capacity is high. This soil cracks when dry. Flooding is at intervals of once in about 30 years.

This soil is suited to cultivated crops. Small grain and grain sorghum are the main crops.

Conserving moisture and maintaining or improving tilth are the main concerns of management. The surface crusts after rains. A cropping system that includes deep-rooted crops in the rotation and crops that contribute a large amount of residue to the soil helps to improve tilth and reduces the effects of crusting.

DRYLAND CAPABILITY UNIT IIs–2

This unit consists of deep, nearly level soils on uplands. These soils are well drained to somewhat poorly drained. Permeability is very slow. The available water capacity is high. These soils crack when dry. Seasonal ponding occurs in the slight depressions during years of above-average rainfall.

These soils are suited to cultivated crops. Small grain, grain sorghum, and cotton are the main crops.

Conserving moisture and maintaining or improving tilth are the main concerns of management. A cropping system that contributes a large amount of residue and includes deep-rooted plants in the rotation helps to conserve moisture and maintain and improve tilth. Terracing and contour farming are needed to conserve water and also to help drain some ponded areas.

DRYLAND CAPABILITY UNIT IIs–3

The only soil in this unit is Rowena clay loam, 0 to 1 percent slopes. It is a nearly level, well-drained soil on uplands. It is moderately deep over caliche. Permeability is moderately slow. The available water capacity is high.

This soil is suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Maintaining or improving tilth and conserving moisture are the main concerns of management. A suitable cropping system includes grain sorghum or other high residue-producing crops. Managing residue on the surface helps to maintain or improve tilth and conserve moisture. Terracing and contour farming are needed to control runoff water and conserve moisture.

DRYLAND CAPABILITY UNIT IIc–1

The one soil in this unit, Pedernales fine sandy loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderately slow. The available water capacity is high.

This soil is well suited to cultivated crops. Small grain, grain sorghum, and cotton are the main crops.

Conserving moisture and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes grain sorghum or other crops that produce a large amount of residue. Managing residue on the surface helps to conserve moisture and maintain productivity and tilth. Terracing and contour farming are needed to help control erosion and conserve moisture.

DRYLAND CAPABILITY UNIT IIc–2

The one soil in this unit, Sagerton clay loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderately slow. The available water capacity is high. Clayey layers within the soil restrict the movement of water and plant roots.

This soil is well suited to cultivated crops. Grain sorghum, cotton, and small grain are the main crops.

A cropping system that includes high residue-producing crops and deep-rooted plants is needed to maintain good tilth and conserve moisture. Terracing and contour farming also help to conserve moisture.

DRYLAND CAPABILITY UNIT IIc–3

The one soil in this unit, Salga clay loam, 0 to 1 percent slopes, is deep, nearly level, and well drained. Permeability is moderate. The available water capacity is high.

This soil is well suited to cultivated crops. Small grain, grain sorghum, and cotton are the main crops.

Maintaining or improving tilth and conserving moisture are the main concerns of management. A cropping system that incorporates a large amount of crop residue into the soil is needed. Managing crop residue on the surface helps to improve tilth and conserve moisture. Terracing and contour farming are needed to help control erosion and conserve moisture.

DRYLAND CAPABILITY UNIT IIc–4

This unit consists of deep, nearly level, well-drained soils on bottom lands. Flooding is at intervals of once in 15 to 30 years. Permeability is moderate to moderately slow. The available water capacity is high.

These soils are suitable for cultivation. Small grain, cotton, and grain sorghum are the main crops.

Controlling erosion and maintaining or improving tilth are the main concerns of management. A cropping system that leaves a large amount of residue on the surface is needed to maintain good tilth. A cover crop is needed to prevent scouring when the soils are flooded.

DRYLAND CAPABILITY UNIT IIIe–1

The only soil in this unit is Pedernales fine sandy loam, 1 to 3 percent slopes. It is a deep, well-drained, gently sloping soil on uplands. Permeability is moderately slow. The available water capacity is high. The erosion hazard is moderate.

This soil is suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Maintaining or improving tilth and controlling erosion are the main needs of this soil. A cropping system that

contributes a large amount of residue to the soil helps to maintain or improve tilth. Terracing and contour farming are needed to help control erosion and conserve moisture.

DRYLAND CAPABILITY UNIT IIIe-2

This unit consists of deep, well drained to moderately well drained, gently sloping soils on uplands. These soils crack when dry. Water enters the soil rapidly until the cracks close; then water movement in the soil is very slow. Permeability is very slow. The available water capacity is high.

These soils are suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

Terracing and contour farming are needed for runoff and erosion control. A cropping system that contributes a large amount of crop residue to the soil is needed to conserve moisture and to maintain or improve tilth.

DRYLAND CAPABILITY UNIT IIIe-3

This unit consists of moderately deep to deep, well-drained, gently sloping soils on uplands. Permeability is slow to moderate. The available water capacity is low to moderate. The erosion hazard is moderate.

These soils are suitable for cultivation, but most cultivated areas have been returned to range or are idle. Only a few of the larger fields remain in cultivation. Small grain and sorghum are the main crops.

Controlling erosion, conserving moisture, and improving and maintaining soil tilth are the main concerns of management. A cropping system that contributes a large amount of crop residue to the soil is needed. Terracing and contour farming are needed for runoff and erosion control.

DRYLAND CAPABILITY UNIT IIIe-4

The only soil in this unit is Demona loamy sand, 0 to 3 percent slopes. It is a deep, well-drained, nearly level to gently sloping soil on uplands. Permeability is moderately slow. The available water capacity is moderate. The erosion hazard is moderate.

This soil is suitable for cultivation. Peanuts, grain sorghum, oats, and forage sorghum are the main crops.

Incorporating a large amount of crop residue into the soil is needed to help control erosion, conserve moisture, and maintain or improve tilth.

DRYLAND CAPABILITY UNIT IIIe-5

The only soil in this unit, Karnes loam, 1 to 5 percent slopes, is a deep, well-drained, gently sloping soil on uplands. The available water capacity is high, and permeability is moderately rapid. The erosion hazard is moderate. Excess lime in this soil causes chlorosis in some plants.

This soil is suited to cultivated crops. The cropland acreage is small and is intermingled in broad areas of other soils. Oats and sorghum are the main crops.

Incorporating a large amount of crop residue into the soil is needed to maintain or improve soil tilth. Terracing and contour farming are needed to help control erosion and runoff and conserve moisture.

DRYLAND CAPABILITY UNIT IIIe-6

This unit consists of shallow, well-drained, nearly level to gently sloping soils on uplands. Permeability is moderately slow to slow. The available water capacity is low. The erosion hazard is moderate.

These soils are suitable for cultivation. Small grain and sorghum are the main crops.

Close-growing crops and other crops that produce a large amount of residue are effective in controlling erosion and improving or maintaining tilth. Diversion terraces are needed in some places to control outside water.

DRYLAND CAPABILITY UNIT IIIe-7

This unit consists of moderately deep to shallow, well-drained, gently sloping soils on uplands. Permeability is moderate to moderately slow. The available water capacity is low to high. The erosion hazard is moderate.

These soils are suitable for cultivation. Small grain and sorghum are the main crops.

Close-growing crops and high residue-producing crops are needed for runoff and erosion control. Incorporating a large amount of residue into the soil helps to maintain or improve tilth and control runoff and erosion.

DRYLAND CAPABILITY UNIT IIIw-1

The only soil in this unit is the deep, somewhat poorly drained, nearly level Randall clay. Permeability is very slow. The available water capacity is high. Some depressions are ponded during years of heavy rainfall.

This soil is suitable for cultivation. Small grain, grain sorghum, and cotton are the main crops.

A suitable cropping system includes crops that produce a large amount of residue. Managing crop residue on the surface helps to maintain or improve soil tilth. Terracing and contour farming are needed to conserve water and help to drain some ponded areas.

DRYLAND CAPABILITY UNIT IIIs-1

The only soil in this unit is Mereta clay loam, 0 to 1 percent slopes. It is a shallow, well-drained, nearly level soil on uplands. It is underlain by caliche. Permeability is moderately slow. The available water capacity is low.

This soil is suitable for cultivation. Small grain, grain sorghum, and some cotton are the main crops.

A cropping system that provides a large amount of residue to be incorporated into the soil is needed to conserve moisture and maintain or improve tilth. Level, closed-end terracing and contour farming are needed to control runoff and conserve moisture.

DRYLAND CAPABILITY UNIT IVe-1

This unit consists of well-drained, moderately deep to shallow, gently sloping soils on uplands. Permeability is moderately slow to moderately rapid. The available water capacity is low. The excess lime in these soils causes nutrient unbalance and chlorosis in some plants. The erosion hazard is moderate.

These soils are poorly suited to cultivated crops. Most of the soils that were formerly cultivated have been returned to range. The cultivated acreage is small and is in fields with other soils. Oats and sorghum are the main crops.

A suitable cropping system includes crops that produce a large amount of residue. Managing crop residue on the surface helps to improve soil tilth and control erosion.

DRYLAND CAPABILITY UNIT IVe-2

The one soil in this unit, Acove fine sandy loam, 1 to 5 percent slopes, is a moderately deep, well-drained, gently sloping soil on uplands. Permeability is moderately slow. The available water capacity is low. The erosion hazard is moderate.

This soil is suitable for cultivation. Oats, peanuts, and sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining or improving soil tilth are the main concerns of management in cultivated areas. A suitable cropping system includes crops that contribute a large amount of crop residue to the soil. Managing crop residue on the surface helps to control erosion and improves soil tilth. Contour farming and terracing help to control erosion and conserve moisture.

DRYLAND CAPABILITY UNIT IVs-1

This unit consists of moderately deep to deep, nearly level to gently sloping, well-drained soils on uplands. Permeability is slow to moderately slow. The available water capacity is low. The surface crusts after rains. The erosion hazard is moderate.

Most of the acreage is range. Cultivated areas are farmed mostly to small grain and sorghum.

A suitable cropping system should include crops that produce a large amount of residue. Managing crop residue on the surface conserves moisture and maintains or improves tilth.

DRYLAND CAPABILITY UNIT Vw-1

The only soil in this unit is Frio clay loam, channeled. It is well drained and nearly level to gently sloping and is subject to frequent flooding. The flooding interval ranges from 1 year in 2 to twice yearly. Permeability is moderately slow. The available water capacity is high.

This soil is used only as range and wildlife habitat. It is well suited to native grasses.

Maintaining a dense cover of grasses to prevent scouring is the main management need.

DRYLAND CAPABILITY UNIT Vw-2

This unit consists of deep, well-drained, nearly level to gently sloping Dev soils on flood plains. Floodwaters are fast moving and of short duration, and scouring and deposition occur with each flood. Permeability is moderately rapid. The available water capacity is low.

These soils are used as range and wildlife habitat.

A good cover of vegetation is needed to help control erosion.

DRYLAND CAPABILITY UNIT VIe-1

This unit consists of deep to moderately deep, well-drained, undulating to rolling soils on uplands. Permeability is slow to moderately rapid. The available water capacity is low. The erosion hazard is moderate to severe.

These soils are suitable only as wildlife habitat and range.

A good cover of vegetation is needed for erosion control.

DRYLAND CAPABILITY UNIT VIe-2

This unit consists of Yahola soils, strongly sloping. These are deep, well-drained soils on steps and narrow benches and in low-lying areas subject to frequent flooding. Permeability is moderately rapid. The available water capacity is high. The erosion hazard is severe.

These soils are used only as range and wildlife habitat.

Overfall gullies hinder erosion control in many places. A good cover of vegetation is needed to help control erosion. Shaping and seeding critical areas to grasses and diverting water from gullies help in stabilizing these areas.

DRYLAND CAPABILITY UNIT VIs-1

This unit consists of well-drained, shallow to very shallow, gently sloping to sloping soils on uplands. Permeability is slow to moderately slow. The available water capacity is low.

These soils are used as range and wildlife habitat.

A good cover of vegetation is needed for erosion control.

DRYLAND CAPABILITY UNIT VIs-2

This unit consists of well-drained, shallow to moderately deep, gently undulating to undulating soils on uplands. Permeability is slow to moderately slow. The available water capacity is low.

These soils are used as range and wildlife habitat.

A good cover of vegetation is needed for erosion control.

DRYLAND CAPABILITY UNIT VIIs-1

This unit consists of well-drained, shallow to very shallow, rolling to hilly and steep soils on uplands. Permeability is very slow to moderately slow. The available water capacity is low.

These soils are used as range and wildlife habitat.

A good plant cover is needed for erosion control.

DRYLAND CAPABILITY UNIT VIIs-2

This unit consists of very shallow to shallow, moderately well drained to well drained, undulating to steep soils on uplands. Permeability is slow to moderate. The available water capacity is low.

These soils are used as range and wildlife habitat.

A good plant cover is needed to help control erosion.

Predicted Yields

Yields of crops depend chiefly on the tilth and fertility of the soil and on the supply of moisture at the time of planting and throughout the growing season. Lack of sufficient moisture commonly is the reason for limited crop yields in McCulloch County. Consistently favorable yields indicate that fertility has been kept high, good tilth has been maintained, and rainfall has been stored in the soil. Most farming in the county is under dryland conditions. Sprinkler irrigation is used on loamy soils where the main crop is peanuts.

Table 2 gives predicted yields of principal crops grown in the county on arable soils. Soils not generally used for these crops are not listed in table 2. Oats, wheat, grain

sorghum, and cotton are the principal dryland crops. Most peanut crops are irrigated. Yields shown are those where the best applicable management practices are applied.

A high level of management includes (1) growing soil-improving crops, cover crops, and crops that contribute a large amount of residue; (2) keeping crop residue on or near the soil surface; (3) terracing and farming on the contour to conserve water; (4) applying fertilizer according to crop requirements and soil tests; and (5) timely fieldwork and controlling insects and weeds.

Range [2]

One half million acres, or about 75 percent of the agricultural land in McCulloch County, is range. It is used for the production of native vegetation that is grazed by domestic stock and wildlife.

Rangeland as watershed supplies clean water from runoff and underground flow. Recharge and underground water storage is an important function in supplying water for wells, springs, and creeks. Additional values of range are open space, scenery, and recreation. The vegetation is a mixture of grasses, forbs, and shrubs or trees.

The raising of livestock is a major enterprise in the county. Cattle, sheep, and goats are the principal kinds of livestock. Deer and wild turkeys use much of the range area, but are more numerous in areas where soils are associated with limestone hills.

The soils on the limestone hills support live oak, shin oak, and other browse plants, as well as grasses and forbs. These areas are well suited to sheep and goats. The deeper soils in the valleys and lower lying plains support mixed prairie grasses of medium height, short grasses, and some forbs and woody plants. Mesquite has increased and invaded on the deeper soils.

The growth of native vegetation varies according to variations in annual and seasonal rainfall. Years of low rainfall commonly occur in 2 successive years, resulting in decreased forage yield and deterioration of plant cover. Keeping the number of livestock in balance with the varying forage yield is an important concern of the stockman. Plant growth in spring and early in summer normally accounts for 60 to 70 percent of the total amount of forage produced each year. Another growth occurs in fall following fall rains. The more fertile, deep soils produce some grasses that grow late in fall and in winter and early in spring in years when winter rainfall is favorable.

The main concern of the stockman is maintaining the vigor and productiveness of the good forage plants. Managing the time and intensity of grazing, which permits reestablishment and growth of the natural plant community, is essential.

Range sites and condition classes

Soils differ in their capacity to produce native vegetation. The soils capable of producing about the same kind and amount of climax, or original vegetation, make up what is called a *range site*. Climax vegetation refers to the stabilized, potential plant community that a particular range site is naturally capable of growing. This plant community is capable of reproducing itself and does not change so long as the environment remains unchanged. The climax vegetation generally consists of the same kinds of plants that were present when the area was first settled. It generally is the most productive combination of forage plants that will naturally grow on a range site.

The plant community changes when it is subjected to continuous heavy grazing. This change varies with the kinds of livestock and wildlife. Animals graze the palatable plants first and repeatedly. These species lose vigor, grow smaller root systems, and produce fewer seeds. If continually closely grazed, they die out and are replaced by less palatable plants. This process reverses, and the climax plants reestablish and increase on deteriorated range under proper grazing use and deferred grazing.

Decreasers are species in the climax vegetation that tend to decrease in relative amount when the plant community is subjected to continuous heavy grazing. They generally are the plants most palatable to livestock and wildlife. They grow upright so that continuous grazing damages them first.

Increasers are species in the climax plant community that increase in relative amounts as the more desirable plants are reduced in number and size by close grazing. Compared with decreasers, the increasers commonly are shorter, less productive, and less palatable to the grazing animals.

Invaders are kinds of plants that are not a part of the climax plant community. They invade the community and grow along with the increasers after the climax vegetation has deteriorated. Many invaders are plants of low value for grazing. They are capable of reproducing on deteriorated, closely grazed range.

Range condition is the present state of the vegetation of a range site in relation to the climax plant community for that site. The purpose of determining range condition is to provide an approximate measure of deterioration or improvement that has taken place in the plant community. This provides a basis for determining the degree of improvement needed and possible. Most of the range in the county at the time of this survey is in fair condition and has a considerable amount of brush.

Four range condition classes indicate the degree of departure from the potential or climax vegetation brought about by grazing or other use. The classes show the present condition of the vegetation on a range site in relation to the vegetation that is native to the site. The site is in *excellent condition* if 75 to 100 percent of the present vegetation is of the same kind as the climax vegetation. It is in *good condition* if the percentage is between 51 and 75; in *fair condition* if the percentage is between 26 and 50; and in *poor condition* if the percentage is less than 25.

One of the main objectives of good range management is to improve fair and poor range conditions and to keep the range in excellent or good condition. Such management conserves water, improves yields, and protects the soils.

Knowing the range site and range condition is useful in deciding how much improvement can be made and

[2] By Rudy Pederson and Charles Studer, range conservationists, Soil Conservation Service.

TABLE 2.—*Predicted average acre yields of principal crops*

[Absence of figure indicates that the crop is not commonly grown on the soil]

Soil	Oats	Wheat	Grain sorghum	Cotton (lint)	Peanuts (dryland)	Peanuts (irrigated)
	Bu.	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Acove fine sandy loam, 1 to 5 percent slopes	20		1,500		900	2,150
Blanket clay loam, 1 to 2 percent slopes	50	20	1,250	175		
Bonti fine sandy loam, 1 to 5 percent slopes	40		1,500			
Bosque loam, neutral surface	50		3,000			
Brackett loam, 1 to 5 percent slopes	20		700			
Clairemont silt loam	50	20	3,000	375		
Cobb fine sandy loam, 1 to 3 percent slopes	35		1,800		1,200	3,000
Demona loamy sand, 0 to 3 percent slopes	25		2,250		1,200	3,000
Frio clay loam	50	20	3,000	375		
Karnes loam, 1 to 5 percent slopes	30		1,250			
Karnes loam, moderately shallow variant, 1 to 5 percent slopes	15		700			
Kavett silty clay, 1 to 3 percent slopes	30	15	1,250	150		
Krum silty clay, 1 to 3 percent slopes	55	20	2,000	250		
Mereta clay loam, 0 to 1 percent slopes	35	20	1,500	200		
Mereta clay loam, 1 to 3 percent slopes	30	15	1,250	150		
Miles fine sandy loam, 1 to 3 percent slopes	40	20	1,800	275		
Miller silty clay	50	20	2,500	350		
Nuvalde clay loam, 1 to 3 percent slopes	55	20	2,000	250		
Nuvalde-Mereta complex, 2 to 5 percent slopes	30	15				
Pedernales fine sandy loam, 0 to 1 percent slopes	55	30	2,000	250		
Pedernales fine sandy loam, 1 to 3 percent slopes	50	25	1,800	240		
Pontotoc fine sandy loam, 1 to 5 percent slopes	35				800	1,950
Randall clay	40	15	1,125	200		
Randall-Reap complex	40	15	1,500	225		
Reap-Tobosa complex, 1 to 3 percent slopes	35	15	1,500	175		
Rochelle fine sandy loam, 0 to 3 percent slopes	20	15	1,150	150		
Rowena clay loam, 0 to 1 percent slopes	55	20	2,250	275		
Rowena clay loam, 1 to 3 percent slopes	55	20	2,000	250		
Sagerton clay loam, 0 to 1 percent slopes	50	20	1,500	200		
Sagerton clay loam, 1 to 3 percent slopes	50	20	1,250	175		
Salga clay loam, 0 to 1 percent slopes	50	20	2,000	250		
Speck clay loam, 0 to 3 percent slopes	30	15	1,500	175		
Tobosa clay, 0 to 1 percent slopes	40	15	1,500	225		
Tobosa clay, 1 to 3 percent slopes	40	15	1,500	200		
Valera clay, 1 to 3 percent slopes	55	20	2,000	250		
Voca fine sandy loam, moderately shallow variant, 1 to 5 percent slopes	35		1,500			
Voca gravelly sandy loam, 0 to 3 percent slopes	15		1,000			
Yahola fine sandy loam	50	20	2,500	375		

what kind of grazing management is needed. Under good grazing management, natural plant succession is directed toward reestablishment of the climax plant community. Improvement is speeded up by the appropriate application of brush control, range seeding, and deferred grazing.

Descriptions of range sites

In this section the range sites in McCulloch County are described, the composition of the climax vegetation on each range site is given, and the principal invaders are listed. Also given is the approximate total annual yield or herbage yield in air-dry weight per acre for each site in excellent condition in years of favorable and unfavorable growing conditions. Yields for favorable years are the approximate averages of years when forage growth is above average. Yields for unfavorable years are averages when growth is far below average.

ADOBE RANGE SITE

This site consists of moderately deep to shallow soils that have a high lime content. These soils are on hillsides and foot slopes (fig. 19). The available water capacity is low. The forage produced generally is low in quality because these soils are deficient in phosphorus content most of the year. Where plant cover is sparse, the soil erodes easily.

The potential plant community is mainly grasses and Texas oak, live oak, and sumac. The climax vegetation is 40 percent little bluestem, 10 percent tall grama, 10 percent indiangrass, and 10 percent side-oats grama. Other species are Canada wildrye, Wright's three-awn, reverchon panicum, hairy grama, queen's delight, and oaks. Plants that invade the site and make up about 4 percent of the composition are annual forbs, hairy tridens, Texas grama, red grama, and mealycup sage. Juniper invades this site from adjoining rocky slopes. Brush makes up about 10 percent of the vegetation.

The growth of excess oaks can be controlled, and the condition class can be improved by proper grazing management.

The total herbage yield is approximately 4,000 pounds in favorable years and about 1,500 pounds in dry years.

BOTTOMLAND RANGE SITE

This site consists of deep soils in draws and creeks and on river bottoms. The available water capacity is low to

Figure 19.—**Adobe range site on Brackett soils in background. Deep Upland range site on Rowena clay loam in foreground.**

high. Extra moisture is provided by flooding or by runoff from adjacent higher land.

The potential plant community varies, depending on the frequency and amount of flooding. The most productive area is adjacent to the streams. The climax vegetation is 10 percent switchgrass, 10 percent indiangrass, 10 percent little bluestem, 4 percent Arizona cottontop, and 10 percent Canada wildrye. Other important grasses are vine-mesquite, white tridens, meadow dropseed, buffalograss, and Texas wintergrass. Plants that commonly invade the site and make up about 11 percent of the composition are annual weeds, fescue grass, three-awn, tumble windmillgrass, western ragweed, mesquite, lotebush, cactus, and other woody plants. Some elm, hackberry, and pecan are natural to the site. Brush makes up about 15 percent of the composition. Buffalograss and Texas wintergrass tend to be dominant in continually heavily grazed areas.

Livestock prefer to graze on the bottom lands and, as a result, concentrated grazing in these areas has resulted in the loss of the original plant cover. The production of forage can be improved by brush control and a deferred system of grazing. The original plants can be reseeded after dozing or rootplowing the brush.

The total herbage yield ranges from 5,000 to 2,000 pounds, depending on the amount of rainfall and flooding.

DEEP UPLAND RANGE SITE

This range site consists of deep to moderately deep, nearly level to gently sloping soils on uplands. The available water capacity is high. Permeability is moderately rapid to very slow. Where plant cover is depleted, the surface becomes packed or crusted, and erosion is a hazard.

The potential plant community is an open grassland prairie. The climax vegetation is 30 percent side-oats grama, 15 percent Canada wildrye, 5 percent little bluestem, and 10 percent cane bluestem. Other important grasses are buffalograss, Texas wintergrass, meadow dropseed, and vine-mesquite. Plants that invade the site and make up about 8 percent of the vegetation are red grama, Texas grama, three-awn, mesquite, western ragweed, and annuals. Mesquite and low shrubs have invaded this site.

The production of forage can be improved by managing the time and amount of grazing and keeping the forage plants healthy and productive. Mesquite can be controlled by either mechanical or chemical methods. Reseeding can be done successfully after preparing a good seedbed.

The total herbage yield ranges from 5,500 to 1,000 pounds, depending on the season and the amount of rainfall.

GRANITE GRAVEL RANGE SITE

This site consists of moderately deep to deep, nearly level to strongly sloping soils on uplands. Granite crops out on this site. The available water capacity is low.

The potential plant community is an open savannah of post oak, blackjack oak, grasses, and forbs. The climax vegetation is 25 percent little bluestem, 10 percent indiangrass, 8 percent sand lovegrass, 3 percent Canada wildrye, and 3 percent purpletop. Forbs, which make up about 5 percent, are sagewort, dotted gayfeather, lespedeza, and heathaster. Other important grasses are side-oats grama, hooded windmillgrass, plains bristlegrass, vine-mesquite, and Texas wintergrass. Plants that invade the site and make up about 22 percent of the composition are red and gummy lovegrass, tumblegrass, Texas grama, mesquite, whitebrush, and lotebush. Annual weeds and grasses increase and invade and can be dominant where the site is in poor condition.

The total herbage yield ranges from about 4,500 pounds in favorable years to 3,000 pounds in dry years.

GRAVELLY REDLAND RANGE SITE

This site consists of moderately deep, undulating soils on uplands. The available water capacity is low.

The potential plant community consists of some live oak motts, medium-height grasses, and forbs. The climax vegetation is 30 percent side-oats grama, 10 percent green sprangletop, 10 percent cane and pinhole bluestem, 5 percent little bluestem, and 5 percent indiangrass. Other important grasses are Texas wintergrass, buffalograss, curly mesquite, Wright's three-awn, and Arizona cottontop. Plants that invade the site and make up about 14 percent of the composition are mesquite, Texas grama, red grama, and annuals.

Range seeding can be done on the site, but grazing management permits recovery where the better species are present.

The total herbage yield is about 3,500 pounds in favorable years and about 2,000 pounds in dry years.

LOAMY BOTTOMLAND RANGE SITE

This site consists of deep, nearly level to gently sloping soils on flood plains. The available water capacity is high.

The climax vegetation is 15 percent switchgrass, 15 percent indiangrass, and 18 percent little bluestem. Other important species are meadow dropseed, side-oats grama, Canada and Virginia wildrye, hooded windmillgrass, hairy grama, forbs, and annuals. Woody plants make up about 15 percent of the composition.

Periodic resting from grazing and brush control help to maintain production of forage and vigor of the species. The original plant species can be reseeded on this site following the rootplowing of brush.

The total herbage yield is about 5,000 pounds in favorable years and about 3,000 pounds in dry years.

LOW STONY HILL RANGE SITE

This site consists of very shallow to shallow soils on broad, undulating limestone hills and ridges (fig. 20). The available water capacity is low. Limestone fragments occur on the surface, and rock outcrop is common. The rocks concentrate moisture from light rains, which is beneficial to plant growth. Heavy rains of 3 inches or more result in runoff or percolation into the rock crevices.

The potential plant commnuity is a mixture of grasses and forbs. The climax vegetation is 30 percent little bluestem, 15 percent side-oats grama, 10 percent green sprangletop, 5 percent indiangrass, and 2 percent big bluestem. Forbs, such as velvet bundleflower, gaura, and Engelmann daisy, make up about 3 percent of the climax vegetation. Other important plants are Texas wintergrass, hairy grama, and Canada wildrye. Other plants that make up about 25 percent are slim tridens, live oak, shin oak, orange zexmenia, mealycup sage, pricklypear, red grama, and annuals.

Management of grazing is the chief need in maintaining and improving vegetation on this site. The growth of excess oaks can be controlled by mechanical uprooting or by use of chemicals.

The total herbage yield is approximately 1,700 pounds in favorable years and 900 pounds in dry years.

REDLAND RANGE SITE

This site consists of shallow, nearly level to gently sloping soils on uplands. Limestone cobblestones, fragments, and boulders cover up to 70 percent of the surface area. The available water capacity is low.

The potential plant community is a mixture of grasses and scattered oaks. The climax vegetation is 20 percent little bluestem and 5 percent indiangrass. Other important grasses are side-oats grama, Texas wintergrass, buffalograss, and vine-mesquite. Plants that commonly invade the site and make up about 10 percent of the composition are red three-awn, Texas grama, annuals, mesquite, and pricklypear.

Productivity of this site can be improved and maintained through proper grazing management. Thinning out oaks and controlling mesquite are helpful in places.

The total herbage yield ranges from 4,500 pounds to less than 1,700 pounds, depending on the amount of rainfall.

RIVER BREAKS RANGE SITE

This site consists of deep, strongly sloping soils on steps and narrow benches adjacent to the river. Overfall gullies are common and isolate small ridgetops where streams enter the river.

The potential plant community varies according to topography and flooding. Pecan, elm, and hackberry grow in the more moist areas. The climax vegetation is 10 percent switchgrass, 10 percent Canada wildrye, and 15 percent little bluestem. Other important grasses are side-oats grama, hairy dropseed, vine-mesquite, Texas wintergrass, and hooded windmillgrass. Plants that invade the site and make up about 25 percent of the composition are grassbur, sand dropseed, tumble windmillgrass, bermudagrass, silver nightshade, Devilweed aster, mesquite, and whitebrush.

The total herbage yield ranges from 3,500 pounds to 1,500 pounds, depending on the amount of rainfall and flooding.

Figure 20.—**Low Stony Hill range site in excellent condition on Tarrant soils, undulating. Climax grasses are indiangrass, big bluestem, little bluestem, and side-oats grama.**

SANDY RANGE SITE

This site consists of deep, nearly level to gently sloping, sandy soils. The available water capacity is moderate.

The potential plant community is a mixture of oaks, grasses, and forbs. The climax vegetation is 40 percent little bluestem, 10 percent indiangrass, 5 percent switchgrass, 5 percent sand lovegrass, and 5 percent Texas bluegrass. Other important grasses are fall witchgrass, hairy grama, hooded windmillgrass, and side-oats grama. Plants that invade the site and make up about 16 percent of the composition are sand dropseed, low-growing lovegrasses, fringeleaf paspalum, mesquite, catclaw, and annuals.

The total herbage yield is aproximately 4,000 pounds in favorable years and about 2,000 pounds in dry years.

SANDY LOAM RANGE SITE

This site consists of moderately deep to deep, nearly level to gently sloping soils. The available water capacity is low to high.

The potential plant community is a savannah of oak and grasses. The climax vegetation is 20 percent little bluestem, 10 percent indiangrass, 5 percent sand lovegrass, 5 percent purpletop, and 5 percent Canada wildrye. Other important grasses are side-oats grama, fringeleaf paspalum, buffalograss, fall witchgrass, silver bluestem, hairy grama, and hooded windmillgrass. Plants that invade the site and make up about 19 percent of the composition are sand dropseed, low-growing lovegrasses, three-awn, Texas bluegrass, annual weeds and grasses, mesquite, oak, tasajillo, catclaw acacia, whitebrush, persimmon, and lotebush.

The total herbage yield is about 3,800 pounds in favorable years and about 1,800 pounds in dry years.

SANDSTONE HILL RANGE SITE

This site consists of moderately deep, undulating to rolling soils. Sandstone cobblestones and boulders are common on the surface and in the soil. The available water capacity is low.

The potential plant community is grasses and forbs and post oak and blackjack oak. The climax vegetation is 45 percent little bluestem, 5 percent indiangrass, and 5 percent sand lovegrass. Other important grasses are side-oats grama, hairy grama, purpletop tridens, hairy and

tall dropseed, and Arizona cottontop. Important forbs that make up about 5 percent are sagewort, lespedeza, sundrop, and bluebonnet. Plants that invade the site and make up 18 percent of the composition are three-awn, tumble windmillgrass, red grama, red lovegrass, annual weeds and grasses, mesquite, whitebrush, and oaks.

Proper grazing management and brush control, as needed, provide gradual improvement in useable forage growth.

The total herbage yield is about 3,500 pounds in favorable years and about 2,000 pounds or less in dry years. About one-fourth of this yield is oak-leaf twigs and fruit that generally is out of reach of grazing animals.

SCHIST RANGE SITE

This site consists of shallow to moderately deep, undulating soils on uplands. The available water capacity is low to high.

The climax vegetation is 30 percent side-oats grama, 10 percent Arizona cottontop, 5 percent plains lovegrass, and 15 percent pinhole and cane bluestem. Other important grasses are Texas wintergrass, fall witchgrass, Hall's panicum, curly mesquite, and buffalograss. Plants that invade the site and make up about 17 percent of the composition are red grama, Texas grama, croton, dogweed, annual weeds and grasses, whitebrush, persimmon, mesquite, and tasajillo.

The total herbage yield is about 1,800 pounds in favorable years and about 800 pounds in dry years.

SHALLOW RANGE SITE

This site consists of shallow, nearly level to gently sloping soils on uplands. The available water capacity is low.

The potential plant community is a mixture of short and mid grasses, a few forbs, and a few live oaks or motts. The climax vegetation is 40 percent side-oats grama, 10 percent little bluestem, 5 percent cane bluestem, 5 percent vine mesquite, and 5 percent green sprangletop. Other important grasses are buffalograss, Canada wildrye, Texas wintergrass, fall witchgrass, slim tridens, and curly mesquite. Plants that invade the site and make up about 12 percent of the composition are hairy tridens, Texas grama, red grama, annual weeds, mesquite, agrito, and pricklypear.

This site can be improved under proper grazing management. Brush control and reseeding following seedbed preparation can be done successfully on these soils.

The total herbage yield ranges from about 3,500 pounds in favorable years to 1,800 pounds in dry years.

SHALY HILL RANGE SITE

This site consists of shallow, undulating to hilly soils on uplands. The available water capacity is low.

The climax vegetation is 30 percent side-oats grama, 10 percent Arizona cottontop, 10 percent cane bluestem, 3 percent little bluestem, and 3 percent plains lovegrass. Other important grasses are curly mesquite, buffalograss, and fall witchgrass. Plants that commonly invade the site and make up about 20 percent of the composition are mesquite, perennial three-awn, Texas grama, hairy tridens, tasajillo, pricklypear, whitebrush, and junipers.

Seedbed preparation and reseeding are impractical on this site. Brush control and proper grazing management help in the recovery of native range. This site mostly is in small or narrow, elongated areas that complicate grazing distribution.

The total herbage yield is approximately 1,400 pounds in favorable years and about 700 pounds in dry years.

STONY LOAM RANGE SITE

This site consists of very shallow to shallow, undulating to steep soils on uplands. The available water capacity is low.

The potential plant community is a mixture of low shrubs, grasses, and annuals. The climax vegetation is 25 percent side-oats grama, 25 percent green sprangletop, 5 percent plains lovegrass, and 10 percent Arizona cottontop. Other important grasses are perennial three-awn, fall witchgrass, hairy tridens, and slim tridens. Plants that invade the site and make up about 18 percent of the composition are tasajillo, pricklypear, persimmon, red grama, and Texas grama. Woody plants generally are small and scrubby.

The total herbage yield is about 1,200 pounds in favorable years and 500 pounds in dry years.

TIGHT SANDY LOAM RANGE SITE

This site consists of deep to moderately deep, nearly level to gently sloping soils on uplands. The available water capacity is low to high.

The potential plant community is grasses and scattered oak. The climax vegetation is 15 percent side-oats grama, 10 percent vine-mesquite, 5 percent Arizona cottontop, 12 percent little bluestem, and 8 percent indiangrass. Other important grasses are buffalograss, fringeleaf paspalum, hooded windmillgrass, and Texas wintergrass. Plants that invade the site and make up about 20 percent of the composition are mesquite, annuals, red three-awn, red lovegrass, filly and Hall's panicum, and whitebrush.

The total herbage yield is about 3,800 pounds in favorable years and about 2,000 pounds or less in dry years.

VERY SHALLOW RANGE SITE

This site consists of very shallow to shallow, gently undulating soils on uplands. The available water capacity is low.

The potential plant community is open grassland. The climax vegetation is 27 percent side-oats grama, 15 percent little bluestem, and 8 percent green sprangletop. Other important grasses are Wright's and purple three-awn, buffalograss, curly mesquite, fall witchgrass, slim tridens, and hairy grama. Plants that invade the site and make up about 13 percent of the composition are hairy tridens, red grama, croton, pricklypear, mesquite, lotebush, agrito, broom snakeweed, and catclaw acacia.

A seedbed can be prepared on parts of this site with the use of chisel-type equipment, but preparation is difficult. Once the seedbed is prepared, however, reseeding can be done successfully.

The total herbage yield is estimated to be about 2,800 pounds in favorable years and about 1,000 pounds in dry years.

Wildlife [3]

Whitetail deer, turkey, javelina, fox squirrel, bobwhite quail, scaled (blue) quail, dove, cottontail rabbits, jack rabbits, and numerous kinds of nongame birds are the principal kinds of wildlife in McCulloch County. Other kinds are raccoons, foxes, ringtail cats, skunks, opossum, and other furbearing animals. Predators commonly found in the county are bobcats and coyotes. Intermittent lakes, streams, ponds, and grainfields attract ducks and geese during migration. Most farm and ranch ponds are stocked with channel catfish, black bass, and sunfish. The Colorado and San Saba Rivers afford good fishing. Fish and wildlife resources are of much economic importance to landowners in this county.

Successful management of wildlife on any tract of land requires, among other things, that food, cover, and water be available in a suitable combination. Lack of any one of these necessities, unfavorable balance between them, or inadequate distribution of them can severely limit or account for the absence of desired wildlife species. Soil information provides a valuable tool in creating, improving, or maintaining suitable food, cover, and water for wildlife.

Most wildlife habitat is managed by planting suitable vegetation, by manipulating existing vegetation so as to bring about natural establishment or an increase or improvement of desired plants, or by combinations of such practices. The influence of a soil on the growth of plants is known for many species, and can be inferred for others from a knowledge of the characteristics and behavior of the soil. In addition, water areas can be created, or natural ones can be improved as wildlife habitat. Soil information is useful for these purposes.

Soil interpretations for wildlife habitat serve a variety of purposes. They are an aid in selecting the more suitable sites for various kinds of management. They serve as indicators of the level of management intensity needed to achieve satisfactory results. They also serve as a means of showing why it generally may not be feasible to manage a particular area for a given kind of wildlife.

These interpretations also may serve in broad-scale planning of wildlife management areas, parks, and nature areas or for acquiring wildlife lands.

Soil properties that affect the growth of wildlife habitat are: (1) thickness of the soil, (2) texture, (3) available water capacity to a 40-inch depth, (4) wetness, (5) surface stoniness, or rockiness, (6) hazard of flooding, and (7) slope.

The soil areas shown on the soil survey maps are rated without regard to positional relationships with adjoining delineated areas. The size, shape, or location of the outlined area does not affect the rating. In order to determine certain influences on habitat, such as elevation and aspect, onsite appraisal is needed.

In table 3 the soils of McCulloch County are rated for the creation, improvement, or maintenance of six elements of wildlife habitat. These ratings are based upon limitations imposed by the characteristics or behavior of the soil. Four levels of suitability are recognized. Numerical ratings of 1 to 4 indicate the degree of soil suitability for a given habitat element.

Three general kinds of wildlife are considered. *Openland wildlife* consists of birds and mammals that normally frequent cropland, pastures, and areas overgrown with grasses, herbs, and shrubby growth. Examples are quail, cottontail rabbits, jackrabbits, meadow larks, and lark sparrows. *Brushland wildlife* consists of birds and mammals that normally frequent wooded areas of hardwood trees, and shrubs. Examples are deer, turkey, squirrel, raccoon, and javelina. *Wetland wildlife* consists of birds and mammals that normally frequent ponds, streams, ditches, marshes, and swamps, for example, ducks, geese, rails, shorebirds, and snipe.

The habitat suitability ratings used in table 3 are defined as follows:

Well suited indicates that habitat generally is easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected.

Suited indicates that habitat can be created, improved, or maintained in most places; that the soil has moderate limitations that affect management; and that moderate intensity of management and fairly frequent attention are required for satisfactory results.

Poorly suited indicates that habitat can be created, improved, or maintained in most places; that the soil has severe limitations; that habitat management is difficult and expensive and requires intensive effort; and that results are not always satisfactory. For short-term usage, many soils that are poorly suited can provide easy establishment of habitat and have temporary values.

Not suited indicates that the soil limitation is so extreme that it is impractical to manage the designated habitat element. Unsatisfactory results are probable.

The six habitat elements rated in table 3 are defined as follows:

Grain and seed crops are agricultural grains or seed-producing annuals that are planted to produce food for wildlife. Examples are corn, sorghum, millet, soybeans, wheat, oats, and sunflower.

Grasses and legumes refer to domestic perennial grasses and legumes that are established by planting and that furnish food and cover for wildlife. Examples of grasses are bahiagrass, ryegrass, fescue, and panicgrass. Examples of legumes are clover, annual lespedeza, and bush lespedeza.

Wild herbaceous upland plants are perennial grasses, forbs, and weeds that provide food and cover for wildlife. Among these are beggarweed, perennial lespedeza, wild bean indiangrass, wild ryegrass, and bluestem.

Hardwood woody plants are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, or foliage (browse) that is used extensively as food by wildlife. These plants commonly become established through natural processes, but they can be established by planting. Among these plants are oak, mesquite, whitebrush, granjeno, catclaw, cherry grape, honeysuckle, greenbrier, autumn-olive, and multiflora rose.

Wetland food and cover plants are annual and perennial wild herbaceous plants that are in moist to wet sites but do not include submerged or floating aquatics. They

[3] By JAMES HENSEN, biologist, Soil Conservation Service.

TABLE 3.—*Suitability of the soils for elements of wildlife habitat and kinds of wildlife*

[1 means well suited; 2 means suited; 3 means poorly suited; and 4 means not suited]

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Wetland food and cover plants	Shallow water developments	Openland wildlife	Brushland wildlife	Wetland wildlife
Acove:									
AcC	2	1	1	2	4	4	1	1	4
ALD	4	3	1	2	4	4	3	1	4
Blanket: BlB	1	1	1	2	4	4	1	1	4
Bonti:									
BnC	2	1	1	2	4	4	1	1	4
BOC	4	2	1	2	4	4	2	1	4
Bosque: Br	2	1	1	2	4	4	1	1	4
Brackett:									
BsC	3	3	2	2	4	4	3	2	4
BtC, BUE	4	3	3	2	4	4	3	2	4
Cho: CMB	4	3	3	2	4	4	3	2	4
Clairemont: Cn	2	1	1	2	4	4	1	1	4
Cobb: CoB	2	1	1	2	4	4	1	1	4
Demona: DeB	1	1	1	2	4	4	1	1	4
Dev: DV	4	3	3	2	4	4	3	2	4
Frio:									
Fo	2	1	1	2	4	4	1	1	4
Fr	3	2	2	2	4	4	2	1	2
Karnes: KaC	1	1	1	2	4	4	1	1	4
Karnes, moderately shallow variant: KeC	2	2	1	2	4	4	1	1	4
Katemcy: KLC	2	1	1	2	4	4	1	1	4
Kavett: KtB	3	3	2	2	4	4	3	2	4
Krum: KuB	2	2	2	2	4	4	2	1	4
Latom: LAE	4	3	3	2	4	4	3	2	4
Ligon: KLC	4	3	2	2	4	4	3	2	4
Mereta: MeA, MeB	3	2	2	2	4	4	2	2	4
Miles: MfB	1	1	1	2	4	4	1	1	4
Miller: Mr	2	2	2	2	4	4	2	1	4
Nuvalde: NuB, NvC	1	1	1	2	4	4	1	1	4
Owens: OBC, OKD, OTE	4	3	2	2	4	4	3	2	4
Pedernales: PeA, PeB	1	1	1	2	4	4	1	1	4
Pontotoc: PoC	1	1	1	2	4	4	1	1	4
Randall: Ra, Rr	2	2	2	2	2	2	2	2	2
Reap: RtB	2	2	2	2	4	4	2	2	4
Rochelle: RuB	2	1	1	2	4	4	1	1	4
Rowena: RwA, RwB	2	1	1	2	4	4	1	1	4

TABLE 3.—*Suitability of the soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Wetland food and cover plants	Shallow water developments	Openland wildlife	Brushland wildlife	Wetland wildlife
Rumple: RYC	4	3	2	2	4	4	3	2	4
Sagerton: SaA, SaB	1	1	1	2	4	4	1	1	4
Salga: ScA	1	1	1	2	4	4	1	1	4
Speck: SpB, STB	3	3	2	2	4	4	3	2	4
Tarrant: TAC, TKC	4	3	2	2	4	4	3	2	4
Tobosa: ToA, ToB	2	2	2	2	3	3	2	2	3
Valera: VaB	2	2	2	2	4	4	2	2	4
Voca:									
VsB	1	1	1	2	4	4	1	1	4
VsD3	2	1	1	2	4	4	1	1	4
Voca, moderately shallow variant:									
VoC	2	1	1	2	4	4	1	1	4
Yahola:									
Ya	2	1	1	2	4	4	1	1	4
YHD	3	2	1	2	4	4	2	1	4
Yates: YTC	4	3	3	3	4	4	3	3	4

produce food or cover that is extensively and dominantly used by wetland wildlife. Among these plants are smartweed, wild millet, bulrush, spike sedges, rushes, sedges, burreeds, wildrice cutgrass, sourdock, and cattails.

Shallow water developments are low dikes and water-control structures that are established to create habitat principally for water fowl. They may be designed so they can be drained, planted, and flooded, or they may be used as permanent impoundments to grow submerged aquatics.

Engineering Uses of the Soils[4]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. It describes those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell potential, available water capacity, grain-size distribution, plasticity, compressibility, and reaction.

[4] This section was written by ROBERT W. ROTHE, civil engineer, Soil Conservation Service.

Information concerning these and related soil properties is furnished in tables 4, 5, 6, and 7.

The estimates and interpretations of soil properties in these tables can be used in—

1. Planning farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of topsoil for top dressing or road subgrade suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.
5. Determining the suitability of soils for the cross-county movement of vehicles and construction equipment.
6. Obtaining supplemental information from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
7. Developing other preliminary estimates for construction purposes pertinent to the particular area.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and

TABLE 4.—*Estimates of soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table.

Soil series and map symbols	Depth to bedrock	Hydrologic grouping	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Inches		*Inches*			
*Acove: AcC, ALD For Cobb part of ALD, see Cobb series.	24–40	C	0–15 15–19 19–38 38–64	Fine sandy loam Flaggy sandy clay loam Flaggy clay, clay Weakly cemented sandstone.	SM GC CL, SC	A–2 A–2 A–7
Blanket: BlB	>60	C	0–13 13–44 44–82	Clay loam Clay loam Clay loam	CL CL SC	A–6 A–7 A–6
*Bonti: BnC, BOC For Owens part of BOC, see Owens series.	20–40	C	0–11 11–17 17–25 25–30	Fine sandy loam Clay Sandy clay Strongly cemented sandstone.	SM or ML–CL CL CL or SC	A–4 A–6 A–7
Bosque: Br	>60	B	0–65	Loam	ML	A–6
*Brackett: BsC, BtC, BUE For Tarrant part of BUE, see Tarrant series.	10–20	C	0–17 17–60	Loam Thin-bedded weakly cemented to strongly cemented limestone.	CL or SC	A–6
*Cho: CMB For Mereta part, see Mereta series.	7–20	C	0–10 10–14 14–60	Loam Indurated caliche (rippable). Limy material of about loam texture.	ML or CL ML or CL	A–4 A–4
Clairemont: Cn	>60	B	0–10 10–60	Silt loam Silty clay loam and silt loam	ML–CL, CL CL, ML–CL	A–6 A–6
Cobb: CoB	20–48	B	0–12 12–36 36–40	Fine sandy loam Sandy clay loam Fractured sandstone.	SM SC or CL	A–4 A–6
Demona: DeB	50–80	C	0–26 26–62 62–80	Loamy sand Sandy clay Sandy shale and thin-bedded sandstone.	SM CL	A–2–4 A–7
Dev: DV	48–60	A	0–60	Very gravelly clay loam	GM–GC or SM–SC	A–2
Frio: Fo, Fr	>60	B	0–60	Clay loam, silty clay loam	CL	A–6
Karnes: KaC	>60	B	0–62	Loam	SM, ML–CL	A–6 or A–4
Karnes, moderately shallow variant: KeC.	20–40	B	0–30 30–60	Loam Weakly cemented sandstone.	ML, SM	A–4
*Katemcy: KLC For Ligon part of KLC, refer to Ligon series.	22–40	C	0–8 8–35 35–48	Loam Clay Schist.	CL CL	A–6 A–7
Kavett: KtB	10–20	D	0–16 16–30	Silty clay Strongly cemented limestone and platy caliche.	CH	A–7–6
Krum: KuB	>60	C	0–70	Silty clay	CH or MH–CH	A–7
Latom: LAE	4–14	D	0–6 6–20	Fine sandy loam Cemented calcareous sandstone.	SM, SM–SC	A–2
Ligon. Mapped only with Katemcy soils.	12–20	D	0–5 5–16 16–30	Loam Clay loam Schist.	CL or SC CL	A–6 A–6

properties significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for
The symbol > means more than; the symbol < means less than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
100	100	70–80	15–35	2. 0–6. 3	0. 11–0. 13	6. 1–7. 3	Low.
40–50	30–40	25–35	25–35	0. 2–0. 63	0. 06–0. 08	6. 1–6. 5	Low.
80–95	80–95	75–85	40–65	0. 2–0. 63	0. 13–0. 15	6. 1–6. 5	Moderate.
100	100	90–95	70–80	0. 2–0. 63	0. 16–0. 18	6. 6–7. 8	Low.
100	100	90–95	75–85	0. 2–0. 63	0. 16–0. 18	7. 4–7. 8	Moderate.
55–65	50–60	40–50	36–45	0. 2–0. 63	0. 16–0. 18	7. 4–8. 4	Moderate.
80–100	80–100	35–70	40–55	2. 0–6. 3	0. 11–0. 13	6. 1–7. 3	Low.
90–100	90–100	90–95	50–75	0. 2–0. 63	0. 16–0. 18	5. 1–6. 0	Moderate.
90–100	90–100	85–95	45–60	0. 2–0. 63	0. 15–0. 17	5. 1–6. 0	Moderate.
100	100	85–95	60–75	0. 63–2. 0	0. 14–0. 16	6. 6–8. 4	Low.
70–100	65–100	55–95	40–75	0. 2–0. 63	0. 10–0. 15	7. 9–8. 4	Low.
75–95	70–95	60–80	60–70	0. 63–2. 0	0. 10–0. 15	7. 9–8. 4	Low.
70–95	70–90	65–85	70–80	0. 63–2. 0	----------	7. 9–8. 4	Low.
100	100	100	85–90	0. 63–2. 0	0. 16–0. 19	7. 9–8. 4	Low.
100	100	100	90–95	0. 63–2. 0	0. 16–0. 19	7. 9–8. 4	Moderate.
100	100	75–85	40–50	2. 0–6. 3	0. 11–0. 13	6. 1–7. 3	Low.
100	90–99	90–98	40–55	0. 63–2. 0	0. 12–0. 16	5. 6–7. 3	Low.
100	100	60–75	15–30	2. 0–6. 3	0. 08–0. 10	5. 6–7. 3	Low.
100	100	75–85	51–60	0. 2–0. 63	0. 15–0. 18	5. 6–6. 0	Moderate.
20–60	15–40	10–40	10–35	2. 0–6. 3	0. 05–0. 10	7. 9–8. 4	Low.
100	100	90–100	70–80	0. 2–0. 63	0. 17–0. 19	7. 9–8. 4	Moderate.
100	100	85–95	36–60	2. 0–6. 3	0. 10–0. 15	7. 9–8. 4	Low.
100	100	85–95	36–60	2. 0–6. 3	0. 10–0. 15	7. 9–8. 4	Low.
100	100	70–85	60–75	0. 63–2. 0	0. 14–0. 16	6. 1–7. 3	Low.
100	100	75–85	65–85	0. 06–0. 2	0. 17–0. 19	6. 1–7. 8	Moderate.
95–100	95–100	95–100	85–95	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	High.
100	100	95–100	85–95	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	High.
90–100	85–95	80–90	25–35	0. 63–2. 0	0. 11–0. 13	7. 9–8. 4	Low.
80–100	80–100	70–80	40–75	0. 63–2. 0	0. 10–0. 15	6. 6–7. 8	Low.
80–95	80–95	70–85	51–75	0. 2–0. 63	0. 10–0. 15	6. 6–7. 8	Moderate.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to bedrock	Hydrologic grouping	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Inches		*Inches*			
Mereta: MeA, MeB	14–20	C	0–19	Clay loam	CL	A–6 or A–7
			19–23	Strongly cemented caliche (rippable).		
			23–80	Limy earth of loam and clay loam texture.	CL, ML–CL	A–4, A–6
Miles: MfB	>60	B	0–8	Fine sandy loam	SM	A–4
			8–54	Sandy clay loam	SC or CL	A–6
			54–80	Clay loam	CL	A–6
Miller: Mr	>60	D	0–60	Silty clay	CH	A–7
*Nuvalde: NuB, NvC	>60	C	0–84	Clay loam	CL	A–6 or A–7
For Mereta part of NvC, see Mereta series.						
*Owens: OBC, OKD, OTE	12–20	D	0–18	Clay	CL, CH	A–7
			18–60	Shale	CH, CL	A–7, A–6
For Blanket, Krum, and Tarrant parts of OBC, OKD, and OTE, see Blanket, Krum, and Tarrant series.						
Pedernales: PeA, PeB	>60	C	0–7	Fine sandy loam	SM or ML	A–4
			7–34	Sandy clay	CH or CL	A–6, A–7
			34–86	Sandy clay loam	SC or CL	A–6 or A–7
Pontotoc: PoC	>60	B	0–36	Fine sandy loam	SM or SM–SC	A–4, A–2
			36–72	Sandy clay loam	SC or SM–SC	A–6
			72–76	Fractured sandstone.		
*Randall: Ra, Rr	>60	D	0–64	Clay	CH	A–7
For Reap part of Rr, see Reap series.						
*Reap: RtB	>60	D	0–65	Clay	CH	A–7
For Tobosa part of RtB, see Tobosa series.						
Rochelle: RuB	28–40	C	0–5	Fine sandy loam	SM	A–4, A–2
			5–13	Sandy clay loam	SC	A–6
			13–32	Gravelly sandy clay loam	SC	A–2–6 or A–6
			32–60	Very gravelly sandy loam and sand.	GM, GC, GW–GC	A–2, A–1
Rowena: RwA, RwB	>60	C	0–7	Clay loam	CL	A–6 or A–7
			7–31	Clay	CH	A–7
			31–72	Silty clay loam	CL	A–6 or A–7
Rumple: RYC	20–40	C	0–10	Cherty clay loam	GC, CL	A–2 or A–6
			10–26	Very cherty clay	GC	A–2, A–1
			26–46	Indurated limestone.		
Sagerton: SaA, SaB	>60	C	0–13	Clay loam	CL	A–6
			13–25	Clay	CL	A–6 or A–7
			25–70	Clay loam	CL	A–6
Salga: ScA	>60	C	0–6	Clay loam	CL	A–6
			6–25	Clay loam	CL	A–6, A–7
			25–84	Clay loam	CL	A–6, A–7
*Speck: SpB, STB	14–20	D	0–5	Clay loam	CL	A–6 or A–7
			5–17	Clay	CH	A–7
For Tarrant part of STB, see Tarrant series.			>17	Limestone.		
*Tarrant: TAC, TKC	6–20	D	0–14	Cobbly clay, very cobbly clay	CH, MH	A–7
			14–32	Limestone.		
For Kavett part of TKC, see Kavett series.						

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
98–100	95–100	80–94	70–81	0. 2–0. 63	0. 16–0. 18	7. 8–8. 4	Moderate.
95–100	90–100	75–95	60–90	0. 2–0. 63	0. 16–0. 18	7. 8–8. 4	Low.
100	100	80–85	40–50	2. 0–6. 3	0. 11–0. 13	7. 4–7. 8	Low.
100	100	90–97	36–55	0. 63–2. 0	0. 16–0. 17	7. 4–8. 4	Low.
95–100	90–95	85–90	51–62	0. 63–2. 0	0. 12–0. 14	7. 9–8. 4	Low.
100	100	95–100	90–95	<0. 06	0. 16–0. 18	7. 9–8. 4	High.
80–95	95–100	90–100	60–90	0. 63–2. 0	0. 12–0. 16	7. 9–8. 4	Moderate.
100	100	90–100	80–95	<0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	100	70–80	75–80	<0. 06	0. 03–0. 08	7. 9–8. 4	High.
100	100	70–85	40–55	0. 63–2. 0	0. 11–0. 13	6. 6–7. 3	Low.
100	100	85–90	55–60	0. 2–0. 63	0. 16–0. 18	6. 6–7. 3	High.
100	100	80–90	40–55	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	Moderate.
100	100	75–85	25–40	2. 0–6. 3	0. 12–0. 13	6. 1–7. 3	Low.
100	100	80–90	36–50	0. 63–2. 0	0. 13–0. 15	6. 1–6. 5	Low.
100	100	96–100	75–95	<0. 06	0. 16–0. 18	7. 9–8. 4	High.
98–100	98–100	90–100	75–90	<0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	100	70–80	25–45	2. 0–6. 3	0. 10–0. 15	6. 6–7. 8	Low.
80–95	75–90	60–80	36–50	0. 63–2. 0	0. 10–0. 15	6. 6–7. 8	Low.
75–85	55–65	50–60	15–45	0. 2–0. 63	0. 05–0. 10	6. 6–7. 8	Low.
10–40	5–30	5–25	5–20	0. 63–2. 0	<0. 05	7. 9–8. 4	Low.
100	100	90–100	70–80	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	Moderate.
98–100	98–100	90–100	75–90	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	High.
80–100	70–85	65–90	60–80	0. 2–0. 63	0. 11–0. 15	7. 9–8. 4	High.
50–80	50–75	40–75	25–75	0. 63–2. 0	0. 10–0. 12	6. 1–7. 8	Low.
30–45	30–40	30–40	20–30	0. 2–0. 63	0. 08–0. 10	6. 1–6. 5	Moderate.
100	100	90–100	70–80	0. 2–0. 63	0. 16–0. 18	6. 6–7. 8	Low.
100	100	90–100	75–85	0. 2–0. 63	0. 16–0. 18	7. 9–8. 4	Moderate.
90–100	90–100	75–90	60–75	0. 2–0. 63	0. 10–0. 15	7. 9–8. 4	Low.
95–100	95–100	90–100	60–90	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	Low.
95–100	95–100	90–100	65–90	0. 63–2. 0	0. 16–0. 20	7. 9–8. 4	Moderate.
80–95	70–90	60–85	60–80	0. 6–2. 0	0. 12–0. 16	7. 9–8. 4	Moderate.
100	100	80–95	75–80	0. 2–0. 63	0. 16–0. 18	6. 1–7. 8	Low.
75–95	75–95	75–95	75–95	0. 06–0. 2	0. 16–0. 18	6. 1–7. 8	Moderate.
80–100	80–100	70–90	70–95	0. 2–0. 63	0. 15–0. 17	6. 6–8. 4	High.

TABLE 4.—*Estimates of soil properties*

Soils series and map symbols	Depth to bedrock	Hydrologic grouping	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Inches		*Inches*			
Tobosa: ToA, ToB	>60	D	0–80	Clay	CH	A–7
Valera: VaB	22–40	C	0–33 33–37	Clay Indurated calcium carbonate and fractured hard limestone.	CL	A–7
Voca, moderately shallow variant: VoC.	24–40	C	0–14 14–24 24–40	Fine sandy loam Gravelly sandy clay Gneiss, partially weathered.	SM SC	A–2 A–6
Voca: VsB, VsD3	36–60	C	0–9 9–48 48–60	Gravelly sandy loam Gravelly clay Fragmented granite.	SM SC or GC	A–2 A–7
Yahola: Ya, YHD	>60	B	0–60	Fine sandy loam, loam	SM or ML or ML–CL	A–4, A–2
Yates: YTC	5–10	D	0–6 6–60	Fine sandy loam Indurated coarsely fractured limestone.	CL, SC	A–4, A–6

TABLE 5.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
*Acove: AcC, ALD For Cobb part of ALD, see Cobb series.	Fair: 8 to 18 inches of fine sandy loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity. Severe: bedrock at a depth of 24 to 36 inches.	Severe: slopes are 1 to 12 percent; bedrock at a depth of 24 to 40 inches.	Severe: bedrock at a depth of 24 to 40 inches.
Blanket: BlB	Fair: clay loam texture.	Poor: fair traffic-supporting capacity.	Severe: fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.
*Bonti: BnC, BOC For Owens part of BOC, see Owens series.	Fair: 6 to 13 inches of fine sandy loam. Poor: 5 to 6 inches of fine sandy loam; fragments cover 30 to 75 percent of the surface area.	Fair: fair traffic-supporting capacity; 24 to 40 inches of material. Poor: 20 to 24 inches of material.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability; bedrock at a depth of 20 to 40 inches.
Bosque: Br	Good	Fair: fair traffic-supporting capacity.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-well potential
No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
100	100	90–100	75–95	<0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	100	85–95	80–95	0. 2–0. 63	0. 17–0. 19	7. 9–8. 4	High.
80–95	65–95	30–45	20–30	2. 0–6. 3	0. 08–0. 12	6. 1–7. 3	Low.
80–85	65–75	55–60	40–50	0. 06–0. 2	0. 11–0. 13	6. 1–6. 5	Moderate.
80–95	65–95	30–45	20–30	2. 0–6. 3	0. 08–0. 12	6. 1–7. 3	Low.
50–85	65–70	55–60	45–50	0. 06–0. 2	0. 10–0. 15	6. 1–6. 5	Moderate.
100	100	85–100	30–60	2. 0–6. 3	0. 11–0. 18	7. 9–8. 4	Low.
65–90	65–90	70–85	40–55	0. 63–2. 0	0. 09–0. 10	6. 6–7. 8	Low.

interpretations of the soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Degree and kind of limitation for—Continued			Soil features affecting—		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Severe: bedrock at a depth of 24 to 40 inches.	Severe: bedrock at a depth of 24 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: fair resistance to piping and erosion.	Slope; undulating topography.	Steeper slopes require unusually good vegetative cover for control of erosion.	High: clay texture.	Low.
Slight	Moderate: moderately slow permeability.	Moderate: fair slope stability.	All features favorable.	All features favorable.	Moderate: clay loam texture.	Low.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: medium compressibility; 24 to 40 inches of borrow material. Severe: 20 to 24 inches of borrow material.	Bedrock at a depth of 20 to 40 inches; slope.	Bedrock at a depth of 20 to 40 inches; slope.	High: sandy clay texture.	Moderate: medium to strongly acid.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: medium compressibility; poor resistance to piping and erosion.	Hazard of flooding.	Hazard of flooding.	High: resistivity.	Low.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
*Brackett: BsC, BtC, BUE—For Tarrant part of BUE, see Tarrant series.	Poor: calcium carbonate equivalent of more than 40 percent.	Poor: 10 to 20 inches of suitable material.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: moderately slow permeability; bedrock at a depth of 10 to 20 inches.
*Cho: CMB—For Mereta part, see Mereta series.	Fair: 7 to 20 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Severe: indurated caliche at a depth of 7 to 20 inches; slow permeability.
Clairemont: Cn	Fair: 6 to 14 inches of silt loam.	Fair: fair traffic-supporting capacity.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Cobb: CoB	Fair: 6 to 12 inches of fine sandy loam.	Fair: fair traffic-supporting capacity; 24 to 40 inches of material. Poor: 20 to 24 inches of material.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches; fair traffic-supporting capacity.	Slight	Severe: bedrock at a depth of 20 to 40 inches.
Demona: DeB	Poor: loamy sand texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.
Dev: DV	Poor: coarse fragments cover 50 to 90 percent of the surface area.	Good	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Frio: Fo, Fr	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Severe: hazard of flooding.	Severe: moderately slow permeability; hazard of flooding.
Karnes: KaC	Poor: calcium carbonate equivalent of more than 40 percent.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight

interpretations of the soils—Continued

Degree and kind of limitation for—Continued			Soil features affecting—		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: 10 to 20 inches of borrow material.	Bedrock at a depth of 10 to 20 inches; slope; coarse fragments cover the surface area.	Bedrock at a depth of 10 to 20 inches; slope; coarse fragments cover the surface area.	High: resistivity.	Low.
Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: 7 to 20 inches of borrow material.	Indurated caliche at a depth of 7 to 20 inches.	Indurated caliche at a depth of 7 to 20 inches.	High: conductivity.	Low.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: poor to fair resistance to piping and erosion.	Hazard of flooding.	Hazard of flooding.	Low	Low.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches; moderate permeability.	Moderate: medium compressibility; poor resistance to piping and erosion. Severe: 20 to 24 inches of borrow material.	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Low	Low.
Severe: seepage from surface layer.	Moderate: moderately slow permeability.	Moderate: poor to fair resistance to piping and erosion.	Erodible	Low fertility; hazard of soil blowing.	High: sandy clay texture; moderately well drained.	Moderate: sandy clay texture; medium acid.
Severe: moderately rapid permeability; coarse fragments cover 50 to 90 percent of the surface area.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Hazard of flooding; very gravelly.	Hazard of flooding; very gravelly.	Moderate: conductivity.	Low.
Slight	Moderate: moderately slow permeability.	Moderate: medium compressibility.	Hazard of flooding.	Hazard of flooding.	High: silty clay loam texture; resistivity.	Low.
Severe: moderately rapid permeability.	Severe: moderately rapid permeability; calcareous.	Moderate: medium compressibility.	High lime content.	Suitable vegetative cover difficult to maintain.	Moderate: conductivity.	Low.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Karnes, moderately shallow variant: KeC.	Poor: calcium carbonate equivalent of more than 40 percent.	Fair: fair traffic-supporting capacity at a depth of 24 to 40 inches. Poor: 20 to 24 inches of material.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: 36 to 40 inches to bedrock.	Slight	Severe: bedrock at a depth of 20 to 40 inches.
*Katemcy: KLC For Ligon part of KLC, see Ligon series.	Fair: 5 to 9 inches of loam.	Poor: 22 to 24 inches of material. Fair: fair traffic-supporting capacity; 24 to 40 inches of material.	Severe: bedrock at a depth of 22 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: moderate shrink-swell potential.	Severe: bedrock at a depth of 22 to 40 inches; slow permeability.
Kavett: KtB	Poor: silty clay texture.	Poor: 10 to 20 inches of suitable material; high shrink-swell potential; poor traffic-supporting capacity.	Severe: bedrock at a depth of 10 to 20 inches; poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential; bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches; moderately slow permeability.
Krum: KuB	Poor: silty clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.
Latom: LAE	Fair: 6 to 14 inches of fine sandy loam. Poor: 4 to 6 inches of fine sandy loam.	Poor: 4 to 14 inches of material.	Severe: bedrock at a depth of 4 to 14 inches; slopes of 6 to 30 percent.	Severe: bedrock at a depth of 4 to 14 inches; slopes of 6 to 30 percent.	Severe: bedrock at a depth of 4 to 14 inches; slopes of 10 to 30 percent.
Ligon Mapped only with Katemcy soil.	Fair: 6 to 7 inches of loam. Poor: 4 to 6 inches of loam.	Poor: 12 to 20 inches of suitable material.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.
Mereta: MeA, MeB	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: strongly cemented caliche at a depth of 14 to 20 inches.
Miles: MfB	Fair: 6 to 11 inches of fine sandy loam. Poor: 5 to 6 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
Miller: Mr	Poor: silty clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential; hazard of flooding.	Severe: very slow permeability.

interpretations of the soils—Continued

Degree and kind of limitation for—Continued			Soil features affecting—		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches; moderately rapid permeability.	Moderate: medium compressibility; poor resistance to piping and erosion. Severe: 20 to 24 inches of borrow material.	High lime content; bedrock at a depth of 20 to 40 inches.	Suitable vegetative cover difficult to maintain; bedrock at a depth of 20 to 40 inches.	Moderate: conductivity.	Low.
Severe: bedrock at a depth of 22 to 40 inches.	Severe: bedrock at a depth of 22 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: medium compressibility; fair resistance to piping and erosion. Severe: 22 to 24 inches of borrow material.	Bedrock at a depth of 22 to 40 inches; slope.	Bedrock at a depth of 22 to 40 inches; slope.	High: clay texture.	Low.
Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: 10 to 20 inches of borrow material.	Bedrock at a depth of 10 to 20 inches.	Shallow soil limits amount of soil removed during construction.	High: silty clay texture; resistivity.	Low.
Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Moderate: moderately slow permeability.	Moderate: high compressibility.	All features favorable.	All features favorable.	High: silty clay texture; resistivity.	Low.
Severe: bedrock at a depth of 4 to 14 inches.	Severe: bedrock at a depth of 4 to 14 inches.	Severe: 4 to 14 inches of borrow material.	Bedrock at a depth of 4 to 14 inches; slope.	Bedrock at a depth of 4 to 14 inches; slope.	Low	Low.
Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: 12 to 20 inches of borrow material.	Bedrock at a depth of 12 to 20 inches.	Bedrock at a depth of 12 to 20 inches.	Moderate: conductivity.	Low.
Severe: strongly cemented caliche at a depth of 14 to 20 inches.	Severe: seepage	Severe: 14 to 20 inches of borrow material.	Shallow depth limits amount of soil removed during construction.	Shallow depth limits amount of soil removed during construction.	High: conductivity; fine texture.	Low.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: medium compressibility; fair to poor resistance to piping and erosion.	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.	Low.
Slight	Slight	Moderate: high compressibility.	Flooding in places.	Flooding in places.	High: silty clay texture.	Low.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
*Nuvalde: NuB, NvC—For Mereta part of NvC, see Mereta series.	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.
*Owens: OBC, OKD, OTE—For Blanket, Krum, and Tarrant parts of these mapping units, see Blanket, Krum, and Tarrant series.	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; slopes of 1 to 30 percent; bedrock at a depth of 12 to 20 inches; high shrink-swell potential.	Severe: high shrink-swell potential; slopes of 1 to 30 percent; bedrock at a depth of 12 to 20 inches.	Severe: very slow permeability; slopes of 10 to 30 percent in places.
Pedernales: PeA, PeB	Fair: 6 to 8 inches of fine sandy loam.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.
Pontotoc: PoC	Fair: 7 to 14 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Slight
*Randall: Ra, Rr—For Reap part of Rr, see Reap series.	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.
*Reap: RtB—For Tobosa part of RtB, see Tobosa series.	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.
Rochelle: RuB	Poor: 4 to 6 inches of fine sandy loam.	Good	Slight	Slight	Severe: moderately slow permeability.
Rowena: RwA, RwB	Fair: 6 to 10 inches of clay loam. Poor: 5 to 6 inches of clay loam.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.
Rumple: RYC	Poor: coarse fragments cover 10 to 50 percent of the surface area.	Poor: bedrock at a depth of 20 to 24 inches. Fair: bedrock at a depth of 24 to 40 inches; fair traffic-supporting capacity; moderate shrink-swell potential.	Severe: bedrock at a depth of 20 to 36 inches; Moderate: bedrock at a depth of 36 to 40 inches.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: moderate shrink-swell potential; bedrock at a depth of 36 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; moderately slow permeability.

interpretations of the soils—Continued

Degree and kind of limitation for—Continued			Soil features affecting—		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Moderate: moderate permeability; slopes of 2 to 5 percent.	Severe: calcareous material; seepage.	Moderate: medium compressibility; fair resistance to piping and erosion.	All features favorable.	All features favorable.	High: clay loam texture; conductivity.	Low.
Moderate: slopes of 2 to 7 percent. Severe: slopes of 7 to 30 percent.	Slight	Moderate: medium to high compressibility; fair resistance to piping and erosion.	Bedrock at a depth of 12 to 20 inches; clayey; slope.	Bedrock at a depth of 12 to 20 inches; clayey; slope.	High: clay texture.	Low.
Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	Moderate: fair to poor resistance to piping and erosion.	All features favorable.	All features favorable.	High: sandy clay loam texture; conductivity.	Low.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair to poor resistance to piping and erosion.	All features favorable.	All features favorable.	Low	Low.
Slight	Slight	Moderate: high compressibility.	All features favorable.	All features favorable.	High: clay texture; somewhat poorly drained.	Low.
Slight	Slight	Moderate: high compressibility.	All features favorable.	All features favorable.	High: clay texture.	Low.
Severe: gravel layers at a depth of 28 to 40 inches.	Severe: gravel layers at a depth of 28 to 40 inches.	Moderate: poor resistance to piping and erosion.	All features favorable.	Suitable cover difficult to maintain.	Moderate: conductivity.	Low.
Slight	Moderate: moderately slow permeability.	Moderate: medium to high compressibility.	All features favorable.	All features favorable.	High: silty clay loam texture; conductivity.	Low.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches; moderately slow permeability.	Slight: 24 to 40 inches of material. Severe: 20 to 24 inches of borrow material.	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Severe: clay texture; conductivity.	Low.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Sagerton: SaA, SaB	Fair: 6 to 8 inches of clay loam. Poor: 5 to 6 inches of clay loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.
Salga: ScA	Fair: 6 to 10 inches of clay loam. Poor: 5 to 6 inches of clay loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.
*Speck: SpB, STB. For Tarrant part of STB, see Tarrant series.	Poor: 4 to 6 inches of clay loam.	Poor: 14 to 20 inches of usable material.	Severe: bedrock at a depth of 14 to 20 inches; poor traffic-supporting capacity.	Severe: bedrock at a depth of 14 to 20 inches.	Severe: bedrock at a depth of 14 to 20 inches; slow permeability.
*Tarrant: TAC, TKC. For Kavett part of TKC, see Kavett series.	Poor: clay texture; coarse fragments cover 10 to 60 percent of the surface area.	Poor: loose stones cover 10 to 60 percent of the surface area; 6 to 20 inches of usable material; high shrink-swell potential.	Severe: bedrock at a depth of 6 to 20 inches; stones cover 10 to 60 percent of the surface area.	Severe: bedrock at a depth of 6 to 20 inches.	Severe: bedrock at a depth of 6 to 20 inches.
Tobosa: ToA, ToB	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.
Valera: VaB	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: bedrock at a depth of 22 to 40 inches; moderately slow permeability.
Voca, moderately shallow variant: VoC.	Fair: 10 to 18 inches of fine sandy loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Severe: bedrock at a depth of 24 to 36 inches. Moderate: fair traffic-supporting capacity; bedrock at a depth of 36 to 40 inches.	Moderate: moderate shrink-swell potential.	Severe: bedrock at a depth of 24 to 40 inches; slow permeability.
Voca: VsB, VsD3	Poor: coarse fragments cover 10 to 30 percent of the surface area.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential. Severe: slopes of 6 to 12 percent.	Moderate: moderate shrink-swell potential.	Severe: slow permeability; bedrock at a depth of 36 to 60 inches.

interpretations of the soils—Continued

Degree and kind of limitation for—Continued			Soil features affecting		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Moderate: moderately slow permeability.	Moderate: medium compressibility; fair resistance to piping and erosion.	All features favorable.	All features favorable.	Moderate: resistivity; clay loam texture.	Low.
Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: medium compressibility; fair resistance to piping and erosion.	All features favorable.	All features favorable.	High: clay loam texture; conductivity.	Low.
Severe: bedrock at a depth of 14 to 20 inches.	Severe: bedrock at a depth of 14 to 20 inches.	Severe: 14 to 20 inches of borrow material.	Bedrock at a depth of 14 to 20 inches	Bedrock at a depth of 14 to 20 inches.	High: clay texture.	Low.
Severe: bedrock at a depth of 6 to 20 inches.	Severe: bedrock at a depth of 6 to 20 inches.	Severe: 6 to 20 inches of borrow material; loose stones cover 10 to 60 percent of the surface area.	Bedrock at a depth of 6 to 20 inches.	Bedrock at a depth of 6 to 20 inches.	High: clay texture.	Low.
Slight	Slight	Moderate: high compressibility.	All features favorable.	All features favorable.	High: clay texture; conductivity.	Low.
Severe: bedrock at a depth of 22 to 40 inches.	Severe: bedrock at a depth of 22 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches; moderately slow permeability.	Severe: 22 to 24 inches of borrow material. Moderate: 24 to 40 inches of borrow material; medium compressibility.	Bedrock at a depth of 22 to 40 inches.	Bedrock at a depth of 22 to 40 inches.	High: clay texture; resistivity.	Low.
Severe: bedrock at a depth of 24 to 40 inches; slopes of 2 to 5 percent.	Severe: bedrock at a depth of 24 to 36 inches. Moderate: bedrock at a depth of 36 to 40 inches.	Moderate: medium compressibility.	Bedrock at a depth of 24 to 40 inches.	Bedrock at a depth of 24 to 40 inches.	High: sandy clay texture.	Moderate: slightly acid.
Severe: bedrock at a depth of 36 to 40 inches; slopes of 7 to 12 percent. Moderate: bedrock at a depth of 40 to 60 inches.	Moderate: bedrock at a depth of 36 to 60 inches.	Moderate: poor to fair resistance to piping and erosion.	Coarse fragments; slope.	Coarse fragments; slope.	Severe: clay texture.	Moderate: slightly acid.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—		
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields
Yahola: Ya, YHD	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; severe where slopes are more than 15 percent.	Severe: hazard of flooding.	Severe if slope is 10 to 16 percent, moderate if 5 to 10 percent, and slight if 0 to 5 percent.
Yates: YTC	Poor: coarse fragments cover 15 to 85 percent of the surface area.	Poor: 5 to 10 inches of useable material.	Severe: bedrock at a depth of 5 to 10 inches.	Severe: bedrock at a depth of 5 to 10 inches.	Severe: bedrock at a depth of 5 to 10 inches.

TABLE 6.—*Engineering*

[Tests performed by Texas Highway Department in accordance with standard

Soil name and location	Parent material	Report No.	Depth	Shrinkage		
				Limit	Lineal	Ratio
Kavett silty clay:			*Inches*			
14 miles west on Farm Road 2028 from its intersection with U.S. Highway 87 in Brady; 3 miles south and 0.5 mile west on county road to gate; 0.8 mile southwest in pasture, which point is 0.5 mile southwest of the principal spillway of waterflow retarding structure. (Modal)	Limestone	68-506-R 68-507-R	0-16 16-30	16 26	16. 2 4. 7	1. 84 1. 58
Mereta clay loam:						
1.8 miles southeast of center of Rochelle on U.S. Highway 190; 150 yards north in cultivated field. (Modal)	Old outwash alluvium.	68-501-R 68-502-R 68-503-R 68-504-R	0-17 17-22 22-45 45-72	16 26 27 20	14. 5 4. 7 3. 2 8. 8	1. 88 1. 57 1. 56 1. 77
Rowena clay loam:						
About 13 miles north of the courthouse in Brady; 2 miles south of the intersection of Farm Roads 504 and 2635 in Lohn; 2.4 miles west on county road in a cultivated field 42 yards south from the center of county road. (Modal)	Old outwash alluvium.	68-491-R 68-492-R 68-493-R	7-31 31-45 45-72	14 23 16	16. 7 6. 3 11. 0	1. 94 1. 72 1. 88

[1] Mechanical analyses according to the AASHO Designation T 88-70 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method

interpretations of the soils—Continued

Degree and kind of limitation for—Continued			Soil features affecting—		Corrosivity class and contributing soil features	
Sewage lagoons	Farm ponds		Terraces and diversions	Waterways	Uncoated steel	Concrete
	Reservoir areas	Embankment				
Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: medium compressibility; poor resistance to piping and erosion.	Hazard of flooding; slope.	Hazard of flooding; slope.	Low	Low.
Severe: bedrock at a depth of 5 to 10 inches.	Severe: bedrock at a depth of 5 to 10 inches.	Severe: 5 to 10 inches of borrow material.	Bedrock at a depth of 5 to 10 inches.	Bedrock at a depth of 5 to 10 inches.	Low	Low.

test data

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification [2]	
Percentage passing sieve—									Percentage smaller than—						
3-in.	1¾ in.	1¼ in.	⅞ in.	⅝ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified
													Percent			
-----	-----	-----	100	99	99	98	97	95	87	70	31	25	54	29	A-7-6	CH
100	82	60	51	47	43	39	35	28	23	22	13	8	36	12	A-2-6	GM-OC
-----	-----	-----	-----	100	99	99	97	94	81	73	43	32	48	24	A-7-6	CL
-----	100	97	76	52	38	28	19	11	7	6	4	3	36	12	A-2-6	GW-GM
-----	-----	-----	-----	-----	100	97	92	77	61	58	38	21	34	9	A-4	ML-CL
-----	-----	-----	-----	-----	100	99	97	94	87	83	56	37	38	21	A-6	CL
-----	-----	-----	-----	100	99	99	98	94	83	76	50	39	52	30	A-7-6	CH
-----	100	98	98	94	89	80	73	68	61	58	44	31	35	15	A-6	CL
-----	-----	-----	-----	-----	100	96	93	88	80	77	53	35	38	23	A-6	CL

and material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[2] Unified and AASHO classifications made by Soil Conservation Service personnel.

[3] Based on AASHO Designation: M 145-66 (*1*).

TABLE 7.—*Limitations of soils for recreational uses*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Camp areas	Picnic areas	Intensive play areas	Paths and trails
*Acove: AcC, ALD—For Cobb part of ALD, see Cobb series.	Moderate: moderately slow permeability; slopes of 8 to 12 percent in some places.	Slight if slope is 1 to 8 percent, moderate if 8 to 12 percent.	Moderate: moderately slow permeability. Severe: slopes of 6 to 12 percent.	Moderate: coarse fragments cover 20 to 30 percent of the surface area.
Blanket: BlB	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.
*Bonti: BnC, BOC—For Owens part of BOC, see Owens series.	Moderate: moderately slow permeability; coarse fragments cover 30 to 50 percent of the surface area. Severe: coarse fragments cover 50 to 75 percent of the surface area.	Slight: slopes of 1 to 8 percent. Moderate: slopes of 8 to 10 percent; coarse fragments cover 30 to 50 percent of the surface area. Severe: coarse fragments cover 50 to 75 percent of the surface area.	Moderate: moderately slow permeability; slopes of 2 to 6 percent. Severe: slopes of 6 to 10 percent; 30 to 75 percent coarse fragments.	Moderate: coarse fragments cover 30 to 50 percent of the surface area. Severe: coarse fragments cover 50 to 75 percent of the surface area.
Bosque: Br	Severe: hazard of flooding.	Moderate: hazard of flooding.	Moderate: hazard of flooding.	Slight.
*Brackett: BsC, BtC, BUE.—For Tarrant part of BUE, see Tarrant series.	Moderate: moderately slow permeability; 25 to 50 percent coarse fragments. Severe: slopes of 15 to 45 percent.	Moderate: coarse fragments cover 25 to 50 percent of the surface area; slopes of 8 to 15 percent. Severe: slopes of 15 to 45 percent.	Severe: slopes of 6 to 45 percent; bedrock at depth of 10 to 20 inches; coarse fragments cover 25 to 50 percent of the surface area.	Moderate: slopes of 15 to 25 percent; coarse fragments cover 25 to 50 percent of the surface area. Severe: slopes of 25 to 45 percent.
*Cho: CMB—For Mereta part, see Mereta series.	Slight	Slight	Severe: cemented caliche at depth of 7 to 20 inches.	Slight.
Clairemont: Cn	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Slight.
Cobb: CoB	Slight	Slight	Moderate: slopes of 1 to 2 percent; bedrock at depth of 20 to 40 inches.	Slight.
Demona: DeB	Moderate: loamy sand texture.	Moderate: loamy sand texture.	Severe: loamy sand texture.	Moderate: loamy sand texture.
Dev: DV	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.
Frio: Fo, Fr	Moderate: moderately slow permeability. Severe: hazard of flooding.	Moderate: hazard of flooding; clay loam texture.	Moderate: moderately slow permeability; clay loam texture. Severe: hazard of flooding.	Moderate: hazard of flooding.
Karnes: KaC	Slight	Slight	Slight if slope is 1 to 2 percent, moderate if 2 to 5 percent.	Slight.
Karnes, moderately shallow variant: KeC.	Slight	Slight	Moderate: bedrock at depth of 20 to 40 inches; slopes of 2 to 5 percent.	Slight.

TABLE 7.—*Limitations of soils for recreational uses*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Intensive play areas	Paths and trails
*Katemcy: KLC---- For Ligon part of this mapping unit, see Ligon series.	Moderate: slow permeability.	Slight----	Moderate: slow permeability; slopes of 2 to 6 percent; bedrock at depth of 22 to 40 inches. Severe: slopes of 6 to 8 percent.	Slight.
Kavett: KtB----	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture; bedrock at depth of 10 to 20 inches.	Severe: silty clay texture.
Krum: KuB----	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.
Latom: LAE----	Slight: slopes of 6 to 8 percent. Moderate: slopes of 8 to 15 percent; coarse fragments cover 30 to 50 percent of the surface area. Severe: slopes of 15 to 30 percent; coarse fragments cover 50 to 85 percent of the surface area.	Slight if slope is 6 to 8 percent. Moderate: slopes of 8 to 15 percent; coarse fragments cover 30 to 50 percent of the surface area. Severe: slopes of 15 to 30 percent; coarse fragments cover 50 to 85 percent of the surface area.	Severe: slopes of 6 to 30 percent; bedrock at depth of 4 to 14 inches; coarse fragments cover 30 to 85 percent of the surface area.	Moderate: slopes of 6 to 25 percent; coarse fragments cover 30 to 50 percent of the surface area. Severe: slopes of 25 to 30 percent; coarse fragments cover 50 to 85 percent of the surface area.
Ligon---- Mapped only with Katemcy soils.	Moderate: moderately slow permeability; coarse fragments cover 20 to 30 percent of the surface area.	Slight: coarse fragments cover 5 to 20 percent of the surface area. Moderate: coarse fragments cover 20 to 30 percent of the surface area.	Severe: bedrock at depth of 12 to 20 inches; coarse fragments cover 20 to 30 percent of the surface area.	Slight.
Mereta: MeA, MeB----	Moderate: clay loam texture.	Moderate: clay loam texture.	Severe: Cemented caliche at depth of 14 to 20 inches.	Moderate: clay loam texture.
Miles: MfB----	Slight----	Slight----	Slight if slope is 1 to 2 percent, moderate if 2 to 3 percent.	Slight.
Miller: Mr----	Severe: silty clay texture; hazard of flooding; very slow permeability.	Severe: silty clay texture.	Severe: silty clay texture; very slow permeability.	Severe: silty clay texture.
*Nuvalde: NuB, NvC--- For Mereta part of NvC, see Mereta series.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture; slopes of 2 to 5 percent.	Moderate: clay loam texture.
*Owens: OBC, OKD, OTE. For Blanket, Krum, and Tarrant parts of these units, see their respective series.	Severe: clay texture; slopes of 15 to 30 percent in some places.	Severe: clay texture; slopes of 15 to 30 percent in some places.	Severe: clay texture; slopes of 6 to 30 percent in some places.	Severe: clay texture; slopes of 25 to 30 percent in some places.
Pedernales: PeA, PeB---	Moderate: moderately slow permeability.	Slight----	Moderate: moderately slow permeability.	Slight.
Pontotoc: PoC----	Slight----	Slight----	Slight if slope is 1 to 2 percent, moderate if 2 to 5 percent.	Slight.

TABLE 7.—*Limitations of soils for recreational uses*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Intensive play areas	Paths and trails
*Randall: Ra, Rr— For Reap part of Rr, see Reap series.	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
*Reap: RtB— For Tobosa part of RtB, see Tobosa series.	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
Rochelle: RuB	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability; slopes of 2 to 3 percent.	Slight.
Rowena: RwA, RwB	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.
Rumple: RYC	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture; coarse fragments cover 20 to 50 percent of the surface area.	Moderate: moderately slow permeability; clay loam texture; coarse fragments cover 10 to 20 percent of the surface area; slopes of 2 to 6 percent. Severe: slopes of 6 to 8 percent; coarse fragments cover 20 to 50 percent of the surface area.	Moderate: clay loam texture; coarse fragments cover 20 to 50 percent of the surface area.
Sagerton: SaA, SaB	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.	Moderate: moderately slow permeability; clay loam texture.	Moderate: clay loam texture.
Salga: ScA	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
*Speck: SpB, STB— For Tarrant part of STB, see Tarrant series.	Moderate: slow permeability; clay loam texture. Severe: rocks cover 50 to 70 percent of the surface area.	Moderate: clay loam texture; rocks cover 20 to 50 percent of the surface area. Severe: rocks cover 50 to 70 percent of the surface area.	Severe: bedrock at depth of 14 to 20 inches; rocks cover 20 to 70 percent of the surface area.	Moderate: clay loam texture; rocks cover 20 to 50 percent of the surface area. Severe: rocks cover 50 to 70 percent of the surface area.
*Tarrant: TAC, TKC— For Kavett part of TKC, see Kavett series.	Severe: clay texture; rocks cover 50 to 60 percent of the surface area.	Severe: clay texture; rocks cover 50 to 60 percent of the surface area.	Severe: clay texture; bedrock at depth of 6 to 20 inches; rocks cover 50 to 60 percent of the surface area.	Severe: clay texture; rocks cover 50 to 60 percent of the surface area.
Tobosa: ToA, ToB	Severe: clay texture; very slow permeability.	Severe: clay texture	Severe: clay texture; very slow permeability.	Severe: clay texture.
Valera: VaB	Severe: clay texture	Severe: clay texture	Severe: clay texture	Severe: clay texture.
Voca, moderately shallow variant: VoC.	Moderate: slow permeability.	Slight	Moderate: slow permeability; slopes of 2 to 5 percent; bedrock at a depth of 24 to 40 inches; dust.	Slight.
Voca: VsB, VsD3	Moderate: slow permeability.	Slight if slope is 0 to 8 percent, moderate if 8 to 12 percent.	Moderate: slow permeability; slopes of 2 to 6 percent; bedrock at depth of 36 to 40 inches. Severe: slopes of 6 to 12 percent.	Slight.

TABLE 7.—*Limitations of soils for recreational uses*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Intensive play areas	Paths and trails
Yahola: Ya, YHD-----	Slight: slopes of 0 to 8 percent. Moderate: slopes of 8 to 15 percent. Severe: slopes of 15 to 16 percent; hazard of flooding.	Slight: slopes of 0 to 8 percent. Moderate: slopes of 8 to 15 percent; hazard of flooding. Severe: slopes of 15 to 16 percent.	Slight: slopes of 0 to 2 percent. Moderate: hazard of flooding; slopes of 2 to 6 percent. Severe: slopes of 6 to 16 percent.	Slight: slopes of 0 to 15 percent; hazard of flooding. Moderate: slopes of 15 to 16 percent.
Yates: YTC----------	Slight: rocks cover 10 to 20 percent of the surface area. Moderate: rocks cover 20 to 50 percent of the surface area. Severe: rocks cover 50 to 75 percent of the surface area.	Slight: rocks cover 10 to 20 percent of the surface area. Moderate: rocks cover 20 to 50 percent of the surface area. Severe: rocks cover 50 to 75 percent of the surface area.	Severe: bedrock at depth of 5 to 12 inches; rocks cover 20 to 75 percent of the surface area.	Slight: rocks cover 10 to 20 percent of the surface area. Moderate: rocks cover 20 to 50 percent of the surface area. Severe: rocks cover 50 to 75 percent of the surface area.

where the excavations are deeper than the depths of layers here reported. The estimated values for traffic-supporting capacity expressed in words should not be assigned specific values. Estimates are generally made to depths of about 5 feet, and interpretations do not apply to greater depths. Small areas of other soils and contrasting situations that may have different engineering properties than those listed are included in the mapping units. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kind of problems that may arise.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have a special meaning in soil science are sand, silt, and clay. These and other terms are defined in the glossary at the back of this survey.

Engineering classification systems

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system (*1*) adopted by the American Association of State Highway Officials and the Unified system used by the Soil Conservation Service engineers, Department of Defense, and others (*9*).

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, a soil is placed 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. In group A–1 are gravelly soils of high bearing capacity, or the best soils for subgrade (foundation), and, at the other extreme, in group A–7 are clayey soils of low bearing capacity when wet, or the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7; and A–7–5, A–7–6. If the soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4. Within each group the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils is shown in table 6; the estimated classification for all soils mapped in the survey area is given in table 4.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are divided into fifteen 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 are designated by symbols for both classes; for example, CH or MH.

Estimated properties of soils

Table 4 provides estimates of soil properties important in engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and on detailed experience in working with the individual kind of soil in the survey area.

In the column "Depth to bedrock," the depth in inches indicates where consolidated material can be found.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the glossary of this survey.

Permeability estimates, as used in table 4, relate only to movement of water downward through undisturbed and uncompacted soil. They do not relate to lateral seepage. The estimates are based on the structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered. These values should not be assumed to be the same as the coefficient "K" for permeability, as used by engineers.

Available water capacity is the amount of capillary water in the soil that is available for plant growth after all free water has drained away.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the glossary.

Shrink-swell potential is an indication of the change in volume to be expected of the soil material when the moisture content changes. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures built in, on, or with such materials.

In the column "Hydrologic grouping," the soils are placed in one of four groups based on the intake of water at the end of storms of long duration that occurred after prior wetting and opportunity for swelling of the soils and without the soils being protected by vegetation. The groups range from open sands (lowest runoff potential—Group A) to heavy clays (highest runoff potential—Group D). Descriptions of these four groups follow.

Group A.—Soils in this group have a high infiltration rate, even when thoroughly wetted. They are chiefly deep, well-drained to excessively drained sands and gravel. They have a high rate of water transmission, which results in low runoff potential.

Group B.—Soils in this group have a moderate infiltration rate when thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils that are moderately fine textured to moderately coarse textured. They have a moderate rate of water transmission.

Group C.—Soils in this group have a slow infiltration rate when thoroughly wetted. They are chiefly soils that have a layer which impedes the downward movement of water or soils that are moderately fine textured to fine textured and have a slow infiltration rate. All have a slow rate of water transmission.

Group D.—Soils in this group have a very slow infiltration rate when thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a high permanent water table, soils that have a claypan or clay layer at or near the surface, and shallow soils that are underlain by nearly impervious material. All have a very slow rate of water transmission.

Salinity and the presence of a seasonal high water table do not affect management of the soils of McCulloch County, so these columns were not included in table 4.

Engineering interpretations

Table 5 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. The soil features affecting the use of the soil are shown. The ratings and other interpretations in this table are based on the estimated engineering properties of the soils given in table 4; on available test data, including those given in table 6; and on field experience. The information applies only to the soils depths indicated in table 4. It is reasonably reliable to depths of about 6 feet for most soils and to depths of several more feet than this for some soils.

Topsoil is a fertile soil or soil material, generally rich in organic matter, that is used as a topdressing for lawns, gardens, roadbanks, and similar uses. The ratings indicate suitability for such use.

Road subgrade is material that is used to build embankments. The ratings indicate performance of soil material that has been moved from borrow areas for these purposes.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soils are rated for this use, and the soil features affecting the rating are shown.

The factors considered in rating the soils for use as foundations for low buildings are those features and qualities of undisturbed soils that affect the suitability for supporting foundations of low buildings less than three stories high. The foundations of a building transmit the weight of the structure onto the natural undisturbed soils. The substratum of the soil generally provides the base for foundations and is the material, therefore, to be evaluated. The Unified Classification System was used for evaluating the soils in terms of shrink-swell potential and shear strength.

Soil features that determine the limitations for septic tank filter fields and sewage lagoons are permeability, ground water level, flood hazard, slope, depth to rock or other impervious material, and creviced material that can cause pollution of water supplies.

The suitability of soils for reservoir areas depends primarily upon the seepage rate. Highly plastic soils have low seepage, and coarse-textured soils have high seepage because they lack binding or sealing characteristics.

The factors considered for farm pond embankments are those features and qualities of disturbed soils that affect their suitability for constructing embankments. Both the subsoil and substratum are evaluated where they are contrasting in character and have significant thickness for use as borrow. The primary features that affect suitability are stability, compaction characteristics, susceptibility to piping, shrink-swell potential, compacted permeability, compressibility, and erosiveness.

Factors considered for diversions and terraces are those features and qualities of soils that affect their stability or hinder layout and construction.

Factors considered for waterways are erosion, depth to bedrock, and ease in establishing desired plants.

Steel pipe needs a protective coating to retard corrosion if it is to be placed in any soil in the county. Corrosivity ratings for steel and concrete are given for the soils in table 5. They are based on soil conditions at a depth of 4 feet.

The suitability of the soils as a source of sand and gravel was not considered in table 5 because very few soils in McCulloch County are suitable sources. Among those that are suitable as sources of sand are Yahola and Demona soils. Gravel is available in Yahola soils and in streambeds a few miles south of Voca. Caliche is plentiful in Cho soils.

Soil features that affect drainage were not considered in the table because drainage is not a concern in McCulloch County, except on Randall soils where temporary ponding occurs during periods of more than normal rainfall.

The suitability of the soils for irrigation was not considered because irrigation is not extensive in the county. Only about 2,000 acres are irrigated, mostly Acove, Cobb, Demona, and Frio soils.

Engineering test data

Table 6 contains the results of engineering tests performed by the Texas State Highway Department on three important soils in McCulloch County. It gives the specific locations where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Shrinkage limit is the point of moisture content at which shrinkage stops and is reported as the moisture content, by oven-dried weight of soil, where this condition prevails. As moisture leaves a soil, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium is reached, where shrinkage stops even though additional moisture is removed.

Lineal shrinkage is the decrease in one dimension and is expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Shrinkage ratio is the volume change, expressed as a percentage of the volume of the dried soil pat, divided by the moisture loss above the shrinkage limit, expressed as a percentage of the weight of the dried soil pat.

Mechanical analysis shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve, but silt and clay pass through a sieve of this size. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method, rather than the pipette method that most soil scientists use in determining the clay in soil samples.

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

Recreational development

Table 7 gives the limitations of the soils in McCulloch County for recreational uses. The degree of limitation is rated as *slight*, *moderate*, and *severe*.

A rating of *slight* indicates that the soil has some limitations, but the limitations are not serious and are easy to overcome.

A rating of *moderate* indicates that the soil has moderate limitations that need to be recognized, but the limitations can be overcome or corrected, generally by practical means.

A rating of *severe* indicates that the soil has severe limitations and that use of the soil is questionable because the limitations are difficult to overcome.

Camp areas.—These ratings apply to areas that are suitable sites for tents and camp trailers and the accompanying activities for outdoor living. These areas are used mostly during the camping season. They require little site preparation. They have to be suitable for unsurfaced parking for cars and camp trailers and for heavy foot traffic by humans, horses, and vehicles. The soils should be free of coarse fragments and rock outcrops. The suitability of the soil for supporting vegetation is a separate soil feature to be considered in the final evaluation of selecting a site for these uses. Factors considered in establishing the ratings are wetness, hazard of flooding, permeability, slope, surface soil texture, presence of coarse fragments, and stoniness or rockiness.

Picnic areas.—These ratings are based only on soil features and do not take into consideration other features, such as the presence of trees or lakes which may affect the desirability of a site. The suitability of the soil for supporting vegetation is a separate soil feature to be considered in the final evaluation of selecting sites for these uses. Factors considered in establishing the ratings are wetness, hazard of flooding, slope, surface soil texture, and stoniness and rockiness.

Intensive play areas.—These ratings apply to areas that are to be developed for playgrounds and sites for organized games, such as baseball, football, and badminton. These areas are subject to intensive foot traffic. Areas selected for this use generally have to be nearly level, have good drainage, and have texture and consistence that give a firm surface. The most desirable soil is free of rock outcrops and coarse fragments. It is assumed that a good cover of vegetation, where needed, can be established and maintained in these areas. Factors considered in evaluating the soils for this use are wetness, hazard of flooding, permeability, slope, surface soil texture, depth to hard bedrock, stoniness, and presence of coarse fragments.

Paths and trails.—These ratings apply to areas that are to be used for trails, cross-country hiking, bridle paths, and nonintensive uses that allow for random movement of people. It is assumed that these areas are to be used as they occur in nature and that little soil is to be excavated for the planned recreational use. The ratings are based only on soil features and do not take into consideration other features that may be important in the selection of a site for this use. The soils that are rated as having severe soil limitations may have the potential for providing more natural beauty and better use than other soils, but they need more preparation or maintenance. Factors considered in establishing the ratings are wetness, hazard of flooding, slope, surface soil texture, and surface stoniness or rockiness.

Structures for retarding floodwater have conservation pools that range from about 10 to 40 acres in size. Brady Reservoir, a multi-purpose structure, which is used for recreation, flood control, and municipal water supply, covers about 2,000 acres at the conservation pool level. These bodies of water and streams provide opportunity

for recreational development. There is potential for residential development around the larger bodies of water.

There are many acres of excellent range for deer and turkeys. Information in table 7 can be used to locate the best sites for cabins and access trails.

Formation and Classification of Soils

This section describes the major factors of soil formation and the processes of horizon formation. It also explains the system of classification currently used and classifies the soils of McCulloch County according to that system.

Factors of Soil Formation

Soil is the thin layer of material at the earth's surface that supports the growth of plants. The five major interacting factors of soil formation are climate, living organisms (especially vegetation), parent material, relief, and time. Variations in one or more of the major factors determine the variety of soils formed in the county.

Climate and living organisms act on parent material and slowly change its form. Air, water, plants, and animals bring about chemical changes and break the parent material into smaller particles. As these changes take place, distinct layers or horizons are formed. Relief, or slope of the land, modifies the effects of climate and living organisms. Parent material affects the kind of profile that can be formed, and in some cases, determines it almost entirely. Time is needed for the formation of distinct horizons.

Climate

The climate of McCulloch County is subtropical. Winters are dry. Summers are hot and humid. The climate is uniform throughout the county, and soil differences are not the result of the effects of climate. Rainfall is not heavy enough to cause much leaching. Calcium carbonate, ranging from films and threads to caliche, occurs at varying depths in many soils, depending on the other factors of soil formation. Some soils lack calcium carbonate in the profile, which apparently resulted from a very low content of calcium in the parent material.

Living organisms

Plants and animals, ranging in size from microscopic organisms to the largest animals and trees, have an important part in soil formation. They add to the supply of organic matter and nitrogen in the soil and cause gains or losses in plant nutrients. Living organisms change the soil structure and help to increase the porosity of the soil.

Vegetation, dominantly mid and tall grasses, has affected soil formation more than other living organisms. It has effectively contributed to the accumulation of organic matter and in darkening the soils.

Parent material

Parent material is the unconsolidated mass of material from which the soil profile forms. It consists of the loose earth materials above solid rock and below the soil. Parent material determines the limits of chemical and mineralogical composition of the soils. The soils in McCulloch County formed from material in eight geological systems. These are the Precambrian, Cambrian, Ordovician, Pennsylvanian, Permian, Cretaceous, Quaternary, and Recent (*4*).

McCulloch County is on the northwest flank of a broad structural dome known as the Llano uplift. Geological erosion was active during the Pennsylvanian and Cretaceous ages so that now the Llano uplift consists of a central core of Precambrian rocks surrounded by Paleozoic rocks, which dip away from the uplift in all directions and underlie the county.

Rocks of Precambrian age consist of weathered granite, schist, and gneiss. Voca soils formed over granite. Katemcy and Ligon soils formed over schist and schistose gneiss.

Cambrian rocks are chiefly sandstone and limestone and border the Precambrian System. Demona soils formed over sandstone and thin-bedded shale, and Yates soils formed over limestone. The Hickory Sandstone member of the Cambrian System is particularly important as an aquifer and is the most important source of ground water in the county in terms of present development and potential future development (*3*).

The Ordovician System consists mostly of hard, coarsely fractured Ellenburger Limestone. Chert is common in the upper part. Soils that formed over Ordovician rocks are mostly Rumple soils and some Tarrant soils.

The Pennsylvanian System consists of alternating beds of sandstone, limestone, and shale which dip to the northwest. Soils that formed in material weathered from sandstone are mostly Bonti soils. A very gravelly soil that has a surface layer of fine sandy loam formed over Rochelle conglomerate southeast of Rochelle. Owens soils formed over shale on short, steep scarps that border areas of Bonti soils. The rest of the Pennsylvanian System consists mostly of limestone and shale. A large area that has outcrops of limestone, short, steep scarps, and some mesalike hills is east of Cow Creek. Mostly Tarrant and Kavett soils formed over the limestone in this area. Owens soils formed over shale on the steep scarps. Old alluvium covers the Pennsylvanian System from Cow Creek westward, except for short, steep, predominantly east-facing scarps.

The Permian System consists of thin-bedded limestone and shale. This system is covered with sediments of old alluvium and has had little effect on local soil formations. A few exposures of the Permian System are visible along cuts made by major drainageways.

The Cretaceous System consists of nearly level layers, from the bottom upward, of sandstone, marl, and limestone. Limestone is soft in the lower layers and grades upward to hard fractured limestone. This system forms an undulating plateau that is bordered by short, steep scarps. Kavett, Tarrant, and Valera are the main soils that formed over limestone. Brackett soils formed on scarps and along basal foot slopes in material weathered

from marl and thin-bedded limestone. Soils that formed over sandstone along and below the base of the scarps are the Latom soils and a Karnes moderately shallow variant.

During the Quaternary period, alluvial material was deposited over extensive areas in McCulloch County. Subsequent erosion has removed most of this outwash from the higher lying areas. Miles and Rochelle soils formed from the sandier material in deposits on stream terraces. Soils that formed in the more loamy material are of the Mereta, Nuvalde, Rowena, Sagerton, and Salga series.

Alluvium has been recently deposited on the flood plains of the Colorado and San Saba Rivers, Brady Creek, and tributaries of these streams. These deposits have been in place for such a short time that little soil formation has taken place. Clairemont, Miller, and Yahola soils are on the flood plain of the Colorado River. Frio soils are along the flood plains of the San Saba River, Brady Creek, and tributaries that drain the limestone uplands. Bosque soils are on the flood plains of intermittent streams that drain the sandy and loamy soils on the uplands.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. If other factors of soil development are equal, the degree of profile development depends on the amount of water that enters the soil. For example, Cho and Kavett soils absorb less moisture and have less distinct horizons than Pedernales and Miles soils that are in lower lying, nearly level to gently sloping areas where water intake and biological activity are greater. In addition, the formation of steep soils is retarded by continuous erosion, especially where soils are not protected by plant cover.

Relief also affects the kind and amount of vegetation on a soil. Soils that have north-facing slopes receive less direct sunlight than those that have south-facing slopes and consequently stay cooler and lose less moisture through evaporation. As a result, north-facing soils have more vegetation and generally more distinct horizons. For the same reason, east-facing soils have more clearly expressed horizons than those of west-facing soils.

Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. A long time generally is required for the formation of well-defined, genetically related horizons. Miles and Voca soils are examples of soils that have been in place a long time and have approached equilibrium with their environment. They are mature soils and show marked horizon differentiation. Examples of young soils that have a weakly expressed profile are Clairemont and Frio soils. These soils are forming in recent deposits on the flood plains of streams.

Where slopes are steep, relief is more important than time as a soil-forming factor. The constant removal of material by erosion prevents the formation of mature soils.

Processes of Soil Formation

The processes involved in the formation of soil horizons in McCulloch County are (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, and (3) formation and translocation of silicate clay minerals. More than one of these processes has been active in most soils.

The accumulation of organic matter in the upper part of the profile is important in the formation of the A1 horizon. Sandy soils are low in organic-matter content. Clayey soils are moderate to high in organic-matter content.

Most soils of this county have been leached, to some degree, of carbonates and bases. This leaching has contributed to the formation of horizons. For example, Miles soils have been leached of most carbonates and show distinct horizons. In contrast, Mereta soils have not been leached and do not show distinct horizons.

The translocation of clay minerals has also contributed to horizon formation in McCulloch County. The eluviated A horizon of some soils is lower in clay content than the B horizon, and the B horizon generally has an accumulation of clay in pores and on ped surfaces. In the soils of this county, leaching of carbonates and soluble salts and the translocation of silicate clays are among the more important processes in horizon differentiation. Miles soils are examples of those in which silicate clays have accumulated in the B horizon.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge in farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*6*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*5*) and was adopted in 1965 (*8*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series of McCulloch County by family, subgroup, and order, according to the current system. Most of the classes of the current system are briefly defined in the following paragraphs.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Acove	Fine, mixed, thermic	Udic Haplustalfs	Alfisols.
Blanket	Fine, mixed, thermic	Pachic Argiustolls	Mollisols.
Bonti	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Bosque	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Brackett	Loamy, carbonatic, thermic, shallow	Typic Ustrochrepts	Inceptisols.
Cho	Loamy, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Clairemont	Fine-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Cobb	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Demona	Clayey, mixed, thermic	Aquic Arenic Paleustalfs	Alfisols.
Dev	Loamy-skeletal, carbonatic, thermic	Cumulic Haplustolls	Mollisols.
Frio	Fine, mixed, thermic	Cumulic Haplustolls	Mollisols.
Karnes	Coarse-loamy, carbonatic, thermic	Typic Ustochrepts	Inceptisols.
Karnes, moderately shallow variant.	Coarse-loamy, carbonatic, thermic	Typic Ustochrepts	Inceptisols.
Katemcy	Fine, mixed, thermic	Udic Haplustalfs	Alfisols.
Kavett	Clayey, montmorillonitic, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Krum	Fine, mixed, thermic	Vertic Haplustolls	Mollisols.
Latom [1]	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Ligon	Loamy, mixed, thermic, shallow	Udic Rhodustalfs	Alfisols.
Mereta	Clayey, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Miles	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Miller	Fine, mixed, thermic	Vertic Haplustolls	Mollisols.
Nuvalde	Fine, mixed, thermic	Typic Calciustolls	Mollisols.
Owens	Clayey, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Pedernales [2]	Fine, mixed, thermic	Udic Paleustalfs	Alfisols.
Pontotoc	Coarse-loamy, mixed, thermic	Rhodic Paleustalfs	Alfisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Reap	Fine, montmorillonitic, thermic	Entic Chromusterts	Vertisols.
Rochelle	Fine-loamy, mixed, thermic	Typic Haplustalfs	Alfisols.
Rowena	Fine, mixed, thermic	Vertic Calciustolls	Mollisols.
Rumple	Clayey-skeletal, mixed, thermic	Udic Argiustolls	Mollisols.
Sagerton	Fine, mixed, thermic	Typic Paleustolls	Mollisols.
Salga	Fine, mixed, thermic	Calcic Paleustolls	Mollisols.
Speck	Clayey, mixed, thermic	Lithic Argiustolls	Mollisols.
Tarrant	Clayey-skeletal, montmorillonitic, thermic	Lithic Calciustolls	Mollisols.
Tobosa	Fine, montmorillonitic, thermic	Typic Chromusterts	Vertisols.
Valera	Fine, montmorillonitic, thermic	Petrocalcic Calciustolls	Mollisols.
Voca, moderately shallow variant.	Fine, mixed, thermic	Udic Paleustalfs	Alfisols.
Voca	Fine, mixed, thermic	Udic Paleustalfs	Alfisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Yates	Loamy-skeletal, mixed, nonacid, thermic	Lithic Ustorthents	Entisols.

[1] The Latom soils mapped in McCulloch County are taxadjuncts to the Latom series. They have a paralithic contact of sandstone that can be cut with a spade.

[2] The Pedernales soils mapped in McCulloch County are taxadjuncts to the Pedernales series. They have a solum more than 60 inches thick.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings to soils. Two exceptions, Entisols and Histosols, occur in many different climates.

The five soil orders in McCulloch County are Entisols, Vertisols, Inceptisols, Mollisols, and Alfisols.

Entisols are recent soils that do not have genetic horizons or that have only the beginning of such horizons. In McCulloch County the Entisols include the soils previously classified as Lithosols and Alluvial soils.

Vertisols are soils in which natural churning or inversion of soil material takes place, mainly through the swelling and shrinking of clays. Soils in this order were formerly called Grumusols.

Inceptisols are generally on young, but not recent, land surfaces. In this county Inceptisols include some of the soils formerly called Lithosols and Regosols.

Mollisols are soils that have high base saturation and a dark-colored A horizon that is friable or soft and has a high content of organic matter. In this order are soils that were formerly called Chernozems, Brunizems, and Rendzinas.

Alfisols are soils that have a clay-enriched B horizon that is high in base saturation. In McCulloch County this order includes soils previously called Reddish Prairie and Red-Yellow Podzolic soils.

SUBORDER: Each order is divided into suborders that are based primarily on soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. Soil properties that are used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Suborders are divided into great groups on the basis of uniformity in kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, and major differences in chemical composition, mainly calcium, magnesium, sodium, and potassium. The great group is the last word in the name of the subgroup, and is therefore not shown separately in table 8.

SUBGROUP: Great groups are divided into subgroups, one representing the central (typic) segment of the group and the others, called intergrades, that have properties of the group and also one or more properties of another great group, subgroup, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are formed by placing one or more adjectives before the name of the great group.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES: As explained in the section "How This Survey Was Made," the series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and arrangement in the profile.

Additional Facts About the County

This section is for readers who want general information about McCulloch County. It describes briefly the farming, climate, natural resources, and flood prevention in the county.

McCulloch County was created from Bexar Territory in 1856 and was formally organized in 1876. The county was named for General Ben McCulloch, a veteran of the Battle of San Jacinto. The population was 173 in 1870 and had grown to 1,533 by 1880. The peak population of the county was 13,883 in 1930, but it had declined to 8,815 by 1960.

Brady, the county seat, became an important shipping center for livestock after completion of the railroad in 1903. Settlement increased rapidly after this date and farming in the county became diversified.

Farming

The main farm enterprises and sources of income in McCulloch County are livestock ranching and farming. About 75 percent of all farmland is in native range. Livestock raising consists mainly of a cow-calf type operation and sheep for the production of wool and lambs. Some angora goats are raised.

Cotton, oats, wheat, grain, sorghum, and peanuts are the main crops grown in the county. The largest acreage planted in cotton was 50,000 acres, which produced 30,000 bales in 1910. In 1941, 9,800 bales were produced on 35,000 acres. In 1949, slightly more than 4,000 bales were produced on 11,500 acres. An average of about 12,000 acres has been planted to cotton during the past several years. About 50,000 acres has been planted to oats yearly for the past 30 years. Acreage planted to wheat has declined from 25,000 acres in 1964 to about 12,000 acres in 1969. Acreage planted to grain sorghum has decreased from 40,000 acres in 1941 to a recent average yearly planting of 30,000 acres. About 1,200 acres of peanuts are grown under sprinkler irrigation each year in the southeastern part of the county.

Small grains are normally grazed in winter and harvested for seed in May or June. Sorghum is harvested mostly for grain, but some is harvested as fodder. Small acreages of sorghum are grown for hay and forage.

The county had 622 farms and ranches in 1959 and 1964. The average size of operating units during this period decreased from 1,061 to 1,042 acres. In 1964, about 70 percent of the owners lived on their land, and about 16 percent of farms and ranches were operated by tenants.

Climate [5]

The climate of McCulloch County is subtropical. Winters are dry, and summers are hot and humid. The mean total precipitation is 23.27 inches annually. Peak periods of rainfall occur late in spring and early in fall, but winter and midsummer are relatively dry periods. In an average year, approximately 72 percent of the rainfall occurs during the warm season, April through October. Most precipitation falls in the form of thundershowers that show considerable variation both in the amount of water received and in the areas covered. Warm, dry weather predominates, although changes may be rapid during the cool season. Prevailing winds have a southerly component during all months. The prevailing wind direction is south-southeasterly in April through September. The area receives approximately 65 percent of the total possible sunshine annually. The mean annual lake evaporation is 65 inches. The mean annual relative humidity is 77 percent at 6:00 a.m., 51 percent at noon, and 45 percent at 6:00 p.m., Central Standard Time. In the relatively dry climate evaporative-type home air conditioners are effective for cooling approximately 90 percent of the time during the warmest months, July and August. Temperature and precipitation data, as recorded at Brady, are shown in table 9.

Winter temperatures are mild. Only on about 2 days does the maximum temperature fail to exceed 32°F. A minimum of 32° or below occurs on about 2 out of 3 nights. Rapid drops in temperature occur when polar Canadian air masses plunge southward across Texas, but periods of very cold weather rarely last longer than 48 to 72 hours. Short periods of warm sunny weather often occur in January and February. Winter is a relatively dry season. Precipitation most often falls as light rain, but freezing rain, sleet, or snow may occur also. Snowfall in the area is almost negligible. A few exceptionally heavy snowfalls bias the long-term arithmetic mean, so this statistic is a poor estimate of expected snowfall.

Spring is characterized by many weather changes, but temperatures are mild. March is relatively dry, but thundershowers increase in April and occur with greatest frequency in May. On rare occasions a thunderstorm late in spring or early in summer is accompanied by damaging wind or hail. March and April are the windiest months of the year.

In summer the daytime temperature is hot. Temperatures of 90° or above occur almost every day, and temperatures of 100° are not uncommon. July and August are relatively dry, with little variation in the day-to-day sequence of the weather.

Fall is a delightful season in McCulloch County. Temperatures are moderate, and frequent changes add greater variety to the weather than is the case in summer. Precipitation increases significantly in September and then decreases as fall progresses.

The warm season, or freeze-free period, averages 226 days. The mean dates of the last occurrence of 32° or below in the spring and the first occurrence of 32° or below in the fall are March 31 and November 12, respectively. Thunderstorms occur on 36 days during an average year.

[5] By ROBERT B. ORTON, State climatologist, National Weather Service.

Flood Prevention

Local interest in flood prevention was stimulated by the flood along Brady Creek in July 1938. The downtown area of Brady was flooded, and extensive damage and property loss was caused on the flood plain of Brady Creek and in other drainageways throughout the county during this period. Scouring and deposition resulted mostly on Clairemont, Frio, and Yahola soils.

Twenty-eight floodwater retarding structures and one multi-purpose structure have been installed in the county. Brady Reservoir, in addition to retarding flood water, provides clear water for municipal and recreational uses.

The prevention of flood damage is the chief purpose for building floodwater-retarding structures, but many of the resulting lakes are used for recreation and for watering livestock. These structures also contribute to the abatement of pollution by retaining sediment that does not reach the major lakes downstream. They also help to control scouring and to lessen deposits of infertile sediments and fertile farmland. Water for downstream use is also improved.

The value of conservation land treatment and upstream flood prevention structures is shown in fig. 21. This figure shows silt retention in a sediment pool.

An average of 20 inches of silt has accumulated after an 18-year period of installation. The sediment storage for this installation, which is the second to have been installed in Deep Creek, has retained about 95.5 acre-feet of silt that would have otherwise been deposited downstream. The Conservation Land Treatment Program being carried out by landowners and operators in the 5,300-acre drainage above the site is proving to be effective. The 56-acre surface area sediment pool was designed to retain the sediment being carried from the watershed in 50 years, at the rate of soil erosion when the work plan was developed in 1950. After 18 years, with 36 percent of the 50-year sediment storage time being used, only 34 percent of the water storage capacity has been replaced by silt. The 281 acre-feet sediment storage caught 95.5 acre-feet of silt, thus reducing the total water storage to 195 acre-feet. Conservation land treatment is credited with lengthening the life of the water storage by reducing sedimentation from the watershed above the installation and will make an even greater contribution as landowners intensify conservation treatment in the years ahead.

Natural Resources

Soil, the most important natural resource in the county, provides products, such as forage for livestock and food and fiber for market and home, that furnish a livelihood for most of the people in the county.

Water, another important natural resource, is available for supplemental irrigation from the Colorado and San Saba Rivers and also from wells in the southeastern part of the county. If an increased water supply becomes available in the future, irrigation would be feasible in

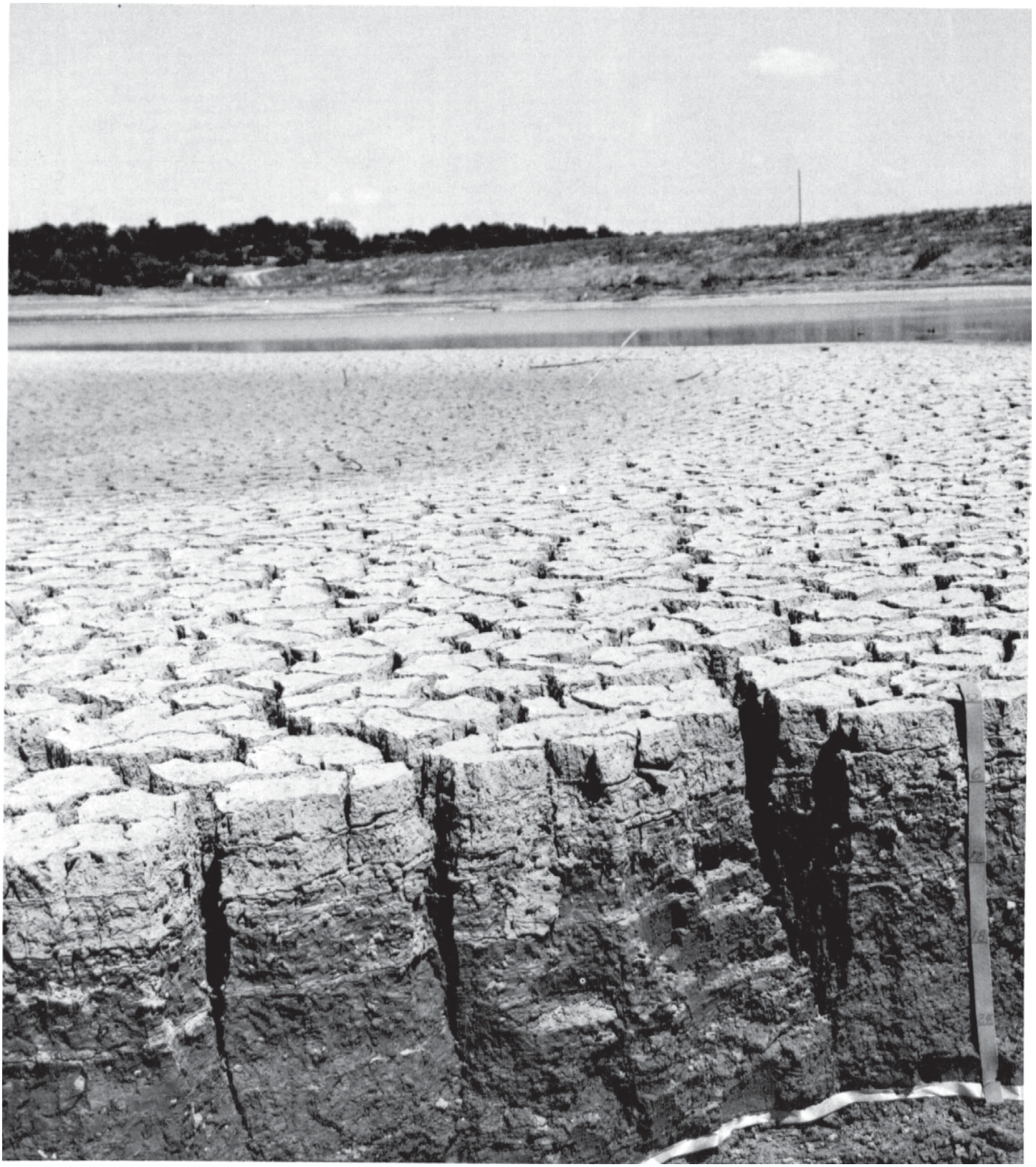

Figure 21.—Silt deposit 28 inches thick in area of maximum siltation, Site 1, Deep Creek.

TABLE 9.—*Temperature and precipitation*

[Elevation 1,748 feet. The

Month	Temperature				Precipitation			
	Average daily maximum	Average monthly maximum	Average daily minimum	Average monthly minimum	Monthly average	Probability of receiving selected amounts		
						0 or trace	0.50 inch or more	1.00 inch or more
	°F.	°F.	°F.	°F.	*Inches*	*Percent*	*Percent*	*Percent*
January	58. 5	78. 6	31. 7	14. 5	1. 52	<1	70	50
February	62. 3	81. 6	35. 4	19. 7	1. 41	<1	75	55
March	69. 9	86. 9	39. 9	24. 9	1. 10	<1	80	60
April	78. 8	92. 7	51. 6	35. 4	2. 58	<1	93	80
May	84. 3	96. 3	60. 3	44. 9	3. 50	<1	99	99
June	91. 3	99. 3	67. 3	58. 7	2. 32	<1	85	70
July	95. 3	101. 5	70. 2	63. 5	1. 34	5	70	60
August	95. 4	102. 6	69. 4	61. 8	1. 61	3	72	60
September	88. 3	98. 8	63. 2	49. 6	3. 05	<1	97	72
October	79. 4	91. 6	52. 7	37. 5	2. 28	4	82	82
November	68. 3	84. 2	40. 5	24. 6	1. 36	5	70	50
December	60. 7	78. 8	32. 5	19. 6	1. 20	5	80	65
Year					23. 27			

[1] Less than half a day.

large areas in the northwestern part of the county. Water is also important for recreational and municipal uses.

The revenue derived from deer hunters provides a supplemental income to many landowners. Other game hunting offers a source of potential revenue.

Caliche is plentiful throughout most of the county. It is used mostly for local road construction.

Frac sand and other grades of sand are mined commercially from Hickory Sandstone near Voca in the southeastern part of the county. An ample amount of well-graded gravel for building purposes is available in creek beds south of Voca. Sand and gravel are also available along the Colorado River.

Literature Cited

(1) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1970. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 10, 2 v., illus.

(2) BALDWIN, MARK, KELLOGG, CHARLES, and THORP, JAMES.
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Ybk., 979–1001, illus.

(3) MASON, C. C., U.S.G.S.
1961. GROUND-WATER GEOLOGY OF THE HICKORY SANDSTONE MEMBER OF THE RILEY FORMATION, MCCULLOCH COUNTY, TEXAS. Tex. Bd. of Water Engrs., Bul. 6017, 84 pp., illus.

(4) SELLARDS, E. N., ADKINS, W. S., and PLUMMER, F. B.
1932. GEOLOGY OF TEXAS. V. 1, STRATIGRAPHY. Univ. of Tex. Bul. 3232, 1007 pp., illus.

(5) SIMONSON, ROY W.
1962. SOIL CLASSIFICATION IN THE UNITED STATES. Sci. 137: 1027–1034, illus.

(6) THORP, JAMES and SMITH, GUY D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126.

(7) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. Agr. Handbook 18, 503 pp., illus.

(8) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(9) UNITED STATES DEPARTMENT OF DEFENSE.
1968. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS AND FOUNDATIONS. MIL–STD–619B, 30 pp., illus.

Glossary

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

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be 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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

at Brady, McCulloch County, Texas, 1939–68

symbol < means less than]

Precipitation—Continued										
Probability of receiving selected amounts—Continued					Average number of days with precipitation of—			Snow, sleet		
2.00 inches or more	3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average monthly	Maximum monthly	Greatest depth
Percent	*Percent*	*Percent*	*Percent*	*Percent*				*Inches*	*Inches*	*Inches*
30	15	10	5	1	2	1	(1)	0.8	4.5	1
30	10	5	3	1	4	1	1	.8	8.8	9
30	10	5	2	1	2	1	(1)	.1	2.0	(2)
60	35	20	10	5	5	2	(1)	0	0	0
90	70	45	30	18	5	3	2	0	0	0
50	32	21	12	11	3	2	1	0	0	0
40	22	12	10	5	2	1	1	0	0	0
31	20	10	5	5	3	1	(1)	0	0	0
50	38	28	20	15	4	2	1	0	0	0
45	29	19	15	9	3	2	1	0	0	0
25	10	4	2	1	4	1	(1)	.4	5.0	5
30	10	5	3	<1	3	1	(1)	.1	1.5	(2)
					40	18	7	2.2	8.8	9

[2] Trace.

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

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found 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 and brittle; little affected by moistening.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms

are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

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 some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Microrelief. Minor surface configurations of the land.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Distintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

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 immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Pore space. That fraction of the total space in a soil that is not occupied by soil particles.

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

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which soil is formed.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Shrink-swell potential (engineering). Amount that a soil will expand when wet or contract when dry. Indicates kinds of clay in the soil.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class 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 relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result in the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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 may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood

plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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