Series 1961, No. 7 Issued August 1964

Soil Survey

ELLIS COUNTY, TEXAS

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Ellis County will serve several groups of readers. It will help farmers and ranchers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; and add to our knowledge of soil science.

Locating the soils

Use the index to map sheets at the back of this report to locate areas on the soil map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the soil map is located. When the correct sheet of the soil map has been found, it will be seen that boundaries of the soils are outlined and that there is a symbol for each kind of soil. Suppose, for example, an area located on the map has the symbol HbA. The legend for the detailed map shows that this symbol identifies Houston Black clay, terrace, 0 to 1 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding information

Special sections in this report will interest different groups of readers, and some sections will be of interest to all.

Farmers and ranchers and those who work with them will want to learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farms and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units" at the back of the report will simplify use of the map and the report. This guide lists, in alphabetic order according to map symbols, the name of each soil and land type mapped in this county and the page where each of these is described. It also lists, for each soil and land type, the capability unit and range site, and the page where each of these is discussed.

Scientists and others who are interested will find information about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Engineers will find information that will assist them in the subsection "Engineering Applications" and in the section "Descriptions of the Soils."

Students, teachers, and other users can learn about the soils and their management in various parts of the report, depending on their particular interest. Newcomers in Ellis County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may be interested in the section "General Facts About Ellis County," which gives additional information.

* * * * *

This soil survey is a part of the technical assistance furnished by the Soil Conservation Service to the three Soil Conservation Districts in the county. These are the Ellis-Prairie, the Dalworth, and the Navarro-Hill Soil Conservation Districts. Assistance in planning conservation on farms and ranches can be obtained from technicians of the Soil Conservation Service who serve the districts. Fieldwork on this survey was completed in 1960. Unless otherwise indicated all statements refer to conditions in the county at the time the survey was in progress.

Cover picture: Aerial view of terracing, contour farming, and stripcropping in Ellis County, Texas.

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SOIL SURVEY OF ELLIS COUNTY, TEXAS

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

ELLIS COUNTY is in the north-central part of the State (fig. 1). It is in the blackland prairie and borders the south side of Dallas County. The Trinity River is the eastern boundary of the county. Waxahachie, the county seat, is 25 miles south of Dallas and is 42 miles southeast of Fort Worth. Ellis has been primarily a cotton-producing county, but now other crops and livestock are produced.

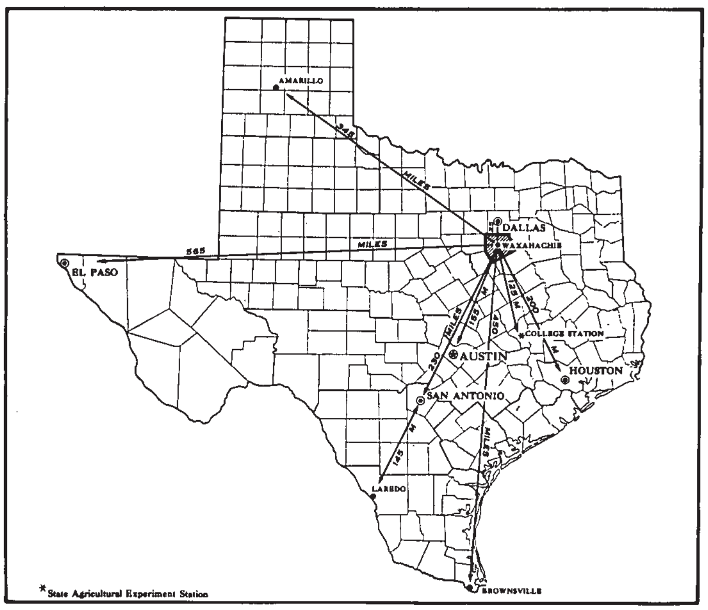

Figure 1.—**Location of Ellis County in Texas.**

Physiography, Relief, and Drainage

Ellis County is mainly gently sloping to sloping, but many large areas on ridges and on flood plains are nearly level, and many areas are strongly sloping to moderately steep.

The county is dissected by numerous well-defined drainage patterns and is well drained. The slope generally is toward the southeast, and most streams empty into the Trinity River. Five creeks in the county are fairly large. Chambers, Mill, Red Oak, and Waxahachie Creeks flow southeast and drain most of the county. Mountain Creek flows northeast and drains about 25,000 acres of the northwestern part of the county; it empties into the Trinity River on the western edge of Dallas. The Austin escarpment, a high chalk ridge, extends in a northeast-southwest direction through the county, southeast of the Mountain Creek watershed, and cuts off drainage to the southeast.

Elevations range from about 300 feet on the lower part of the flood plain of the Trinity River to about 800 feet on the higher part of the Austin escarpment. The average elevation of the blackland prairie is between 400 and 500 feet. The whiterock area on the Austin formation is slightly higher and ranges from 500 to 800 feet. Relief in this area is somewhat more variable than it is in the rest of the county.

How Soils Are Named, Mapped, and Classified

Soil scientists made this survey to learn what kinds of soils are in Ellis County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored 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 to the rock material that has not been changed much by leaching or by roots of plants.

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 uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series (*7*).[1] Except for different texture in the surface

[1] Italic numbers in parentheses refer to Literature Cited, p. 73.

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. Wilson and Houston, 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 natural characteristics.

Many soil series contain soils that are alike except for the texture of their surface layer. According to this difference in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Wilson fine sandy loam and Wilson clay loam are two soil types in the Wilson series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or in some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases. The name of a soil phase indicates a feature that affects management. For example, Wilson fine sandy loam, 1 to 3 percent slopes, is one of several phases of Wilson fine sandy loam, a soil type that ranges from nearly level to gently sloping in Ellis County.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photographs for their base map because these show woodlands, buildings, field borders, trees, and similar detail that greatly help in drawing boundaries accurately. The soil map in the back of this report 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 management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. 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 consisting dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientist has a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, he shows this mixture of soils as one mapping unit and calls it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, for example, Stephen-Eddy complex. Also, in most mapping, there are areas to be shown that are so rocky, so shallow, or so frequently worked by wind and water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gullied land or Slickspots, and are called land types rather than soils.

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 soils. 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 a way that is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. On the basis of yield and practice tables and other data, the soil scientists set up trial groups and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists 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

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations (*2*). Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but patterns of soils, in each of which there are several different kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in other associations, but in a different pattern.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The general soil map of Ellis County shows the nine soil associations, which are described in the following pages. The relation of eight of these associations to the underlying materials is shown in figure 2.

1. Burleson clay, terrace-Houston Black clay, terrace-Lewisville association: Level blackland and valley slopes

This soil association occurs along streams in all parts of the county except the whiterock, or chalk, area. It amounts to about 61,000 acres, or 10 percent of the county. Most of the association is on benches between the sloping upland and the flood plain of streams (fig. 3). The areas are nearly level and sloping. Most of the nearly level areas are large, unfenced black fields in which there are large individual pecan and cottonwood

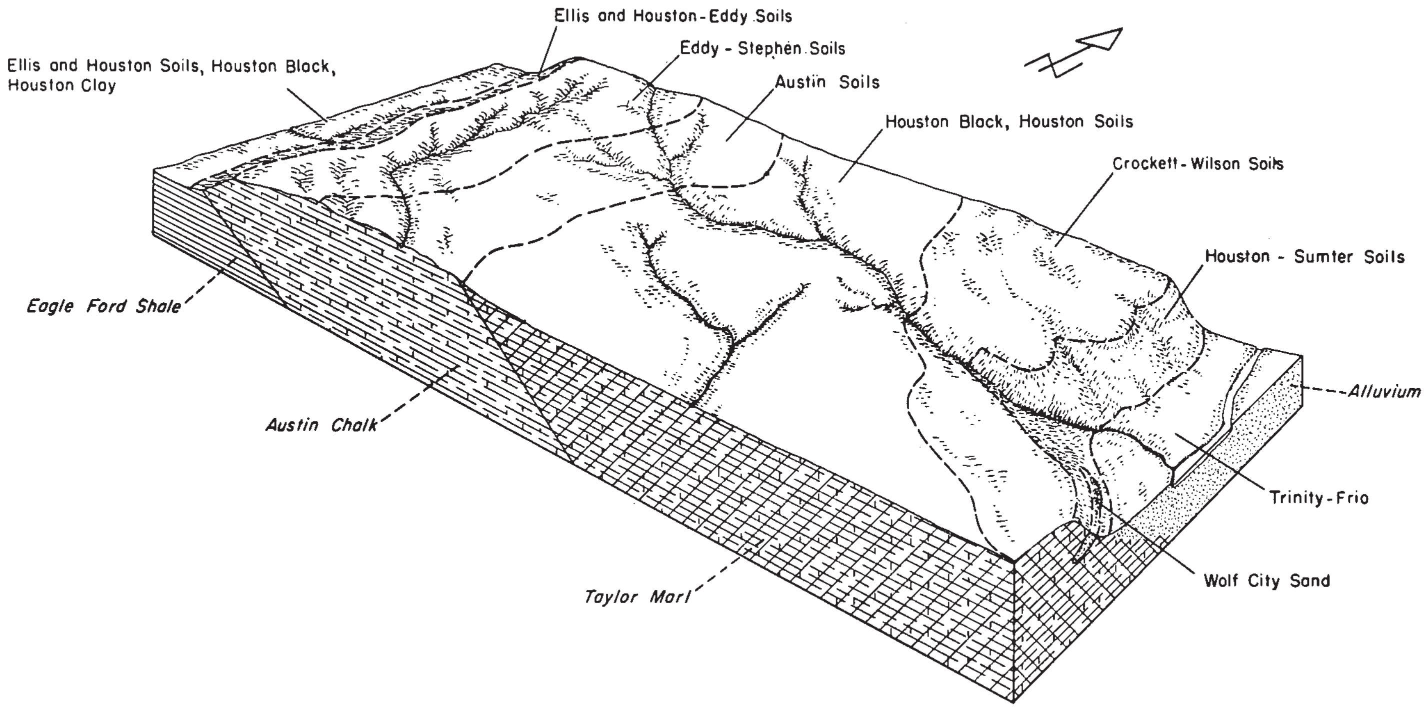

Figure 2.—Block diagram showing relation of eight soil associations in Ellis County to the underlying materials and surface relief.

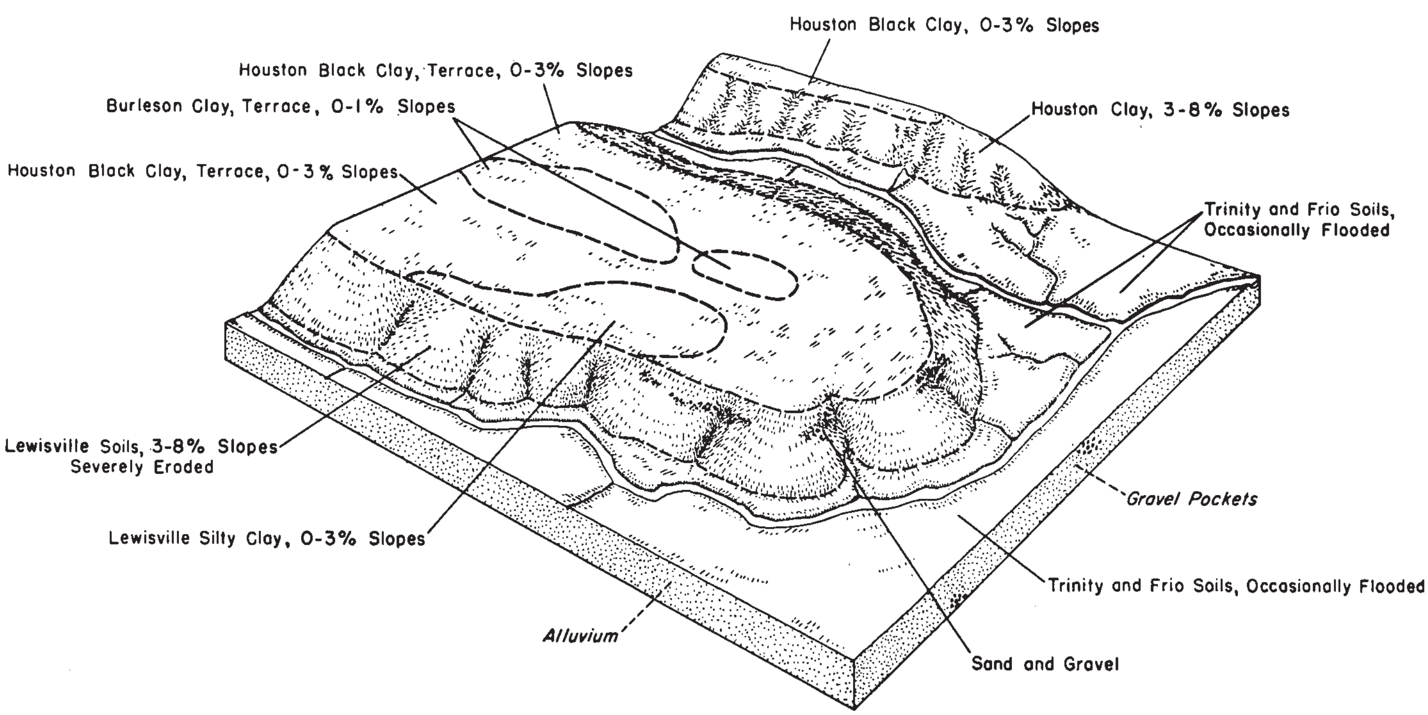

Figure 3.—Geographical association of soils on benches. Burleson clay, terrace; Houston Black clay, terrace; and Lewisville soils are in soil association 1.

trees along field borders, at wells, or around farmsteads. The sloping areas are eroded and are well dissected by natural drains. In these areas the soils are browner than those on benches.

The major soils in this association are the Burleson clays and Houston Black clays, both on nearly level terraces, and the Lewisville soils on valley slopes. The Lewisville soils have developed in old water-laid material and, in most places, contain a substratum of sand and gravel. Minor soils in this association are in the Payne and Wilson series. In the association are shallow wells and springs, as well as most of the commercial gravel that is dug in the county.

The Houston Black soils, on the terraces, are dark heavy clays that produce high yields of cotton, corn, grain sorghum, and other field crops. They are among the most productive soils in the county.

The Burleson soils, also on terraces, are deep, dark, dense clays that are used mostly for common field crops. These soils are tight, are crusty, and do not absorb water readily. They are not so productive as the Houston Black soils. In places the Burleson soils have slow surface drainage.

The Lewisville soils are used mainly for small grains and pasture. Some of the pasture is excellent. Lewisville soils are well suited to bermudagrass and are especially well suited to native and improved pecan trees.

Plowpans are a problem in the Burleson clays and the Houston Black clays if these soils are plowed when wet. Because the sloping Lewisville soils erode readily, they need to be kept in permanent plants to prevent damage.

2. Ellis-Houston-Houston Black association: Moderately deep, shaly, nearly level to rolling blackland

This association occurs west of the Austin chalk (*6*) escarpment and amounts to about 73,000 acres, or 12 percent of the county. It is nearly level to rolling and is eroded along natural drains and slopes. In the less sloping areas are black soils, mainly in unfenced fields. The more sloping areas are usually unfenced and consist of eroded soils that are more brown and olive than the black soils. The association is mainly a general farming area in which much livestock is raised on the large acreage of pasture in the rough land.

In this association most of the Houston Black soils and the gently sloping Houston soils are cultivated. The more sloping Ellis and Houston soils are mainly in pasture. Houston Black soils occur in wide, gently sloping areas that are well dissected by natural drains. The shallow Ellis and Houston soils normally occupy the more sloping areas in this association. These soils overlie grayish shale of the Eagle Ford formation. In the surface layer of many of these soils are fragments of limestone, generally less than 3 inches across.

Representative patterns of the major soils in this association are shown in the lower part of figure 4. Ellis and Houston soils are olive-colored, heavy clays. The surface layer ranges from 5 to 40 inches in thickness and is underlain by clayey shale. This layer is thinnest in the more sloping areas. Many "slickspots," or saline areas, occur in these soils. The Ellis and Houston soils are generally droughty. When they dry after rains, they crack severely. They produce only fair yields of field

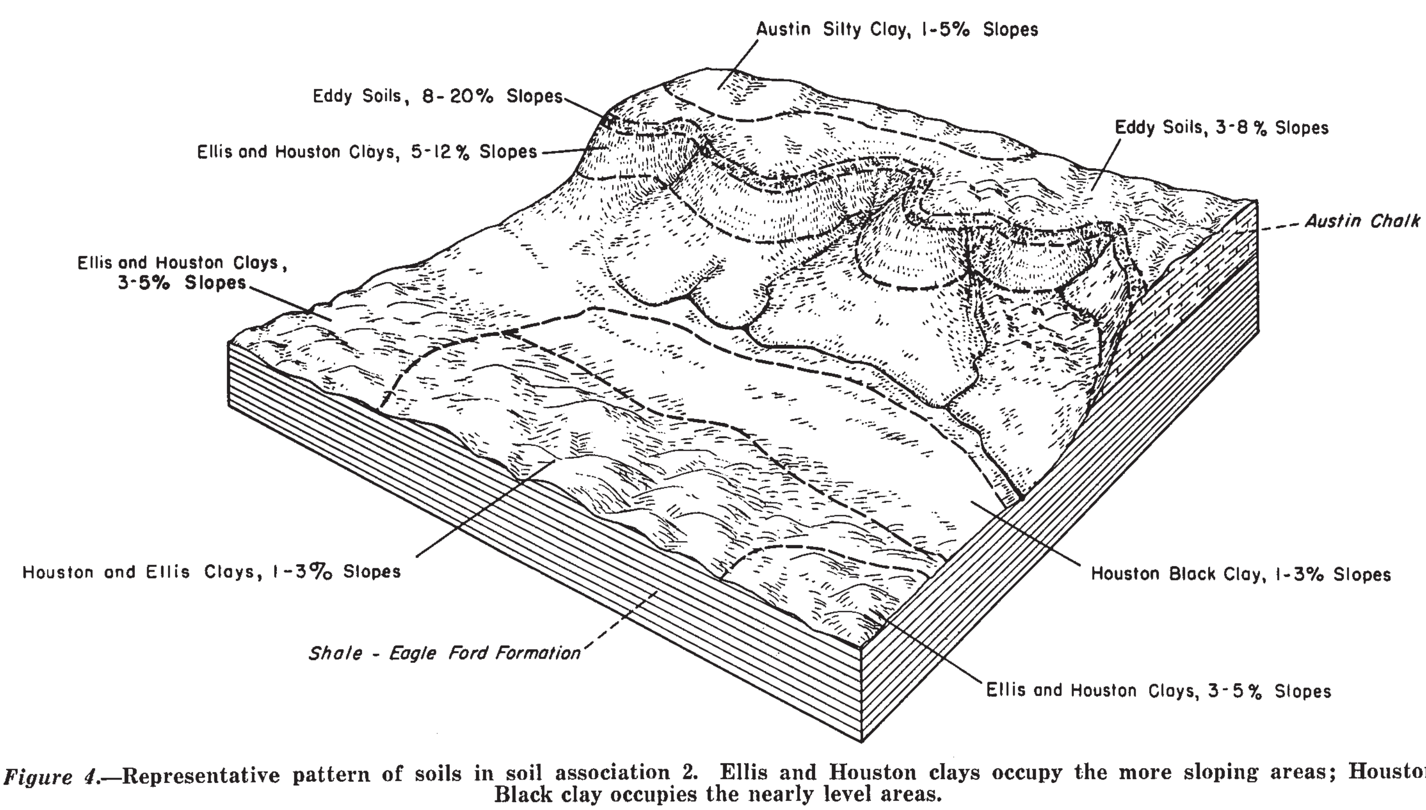

Figure 4.—**Representative pattern of soils in soil association 2. Ellis and Houston clays occupy the more sloping areas; Houston Black clay occupies the nearly level areas.**

crops and are best suited to small grains, sweetclover, and similar crops.

The Houston Black soils are clay and are darker colored, deeper, and more productive than the other soils in this association. They absorb water more readily than the Ellis and Houston soils. The depth to gray shale ranges from 30 to 60 inches.

Houston soils are also clay and are similar to the Ellis and Houston soils in color. They absorb water more readily than the Ellis and Houston soils, and they are less productive and thinner than the Houston Black soils. Houston soils are suited to small grains, sweetclover, and other drilled crops.

3. Ellis-Houston-Eddy association: Shaly and whiterock land

This soil association covers about 24,000 acres, or 4 percent of the county. The soils in the association are shallow and strongly sloping to moderately steep. They occur along the Austin chalk escarpment in the western part of the county. This area was originally in native grasses and scattered trees, but in recent years it has been invaded by mesquite, cactus, a few cedars, and annual weeds and grasses. Most of the steeper areas are in scrubby oaks.

The association is used mainly for small grains, for producing livestock for meat, and for dairy farming. The plowed fields have a distinctly black-and-white appearance because light-colored, gravelly soils occur with the darker soils. The ridges are usually light colored, and the small valleys are dark colored. This area is well dissected by small streams that have steep side slopes and are wooded along the channel. Most of this area is fenced so that fields in small grain can be grazed. These fields are generally equipped with facilities for watering livestock.

The Ellis and Houston soils occur mainly on moderately steep slopes along the western edge of this association. The surface layer ranges from 5 to 14 inches in thickness and is over stiff, olive-yellow clay or grayish shale. These crusty soils crack severely during the hot summer months. Erosion is a major problem and has seriously damaged these soils.

Most of the Eddy soils in this association are gravelly clay loams on breaks between large, gently sloping areas of other Eddy soils and areas of Ellis and Houston clays. The soil material averages about 4 inches in thickness and is over chalky bedrock. About 20 to 40 percent of the soil material is chalk fragments. Outcrops of chalky bedrock are numerous.

The main problems on this association are establishing grazing plants to prevent further erosion and preventing undesirable plants from invading.

4. Eddy-Stephen association: Whiterock land

This association amounts to about 79,000 acres, or about 13 percent of the county; it is in the west-central part. Relief is somewhat rolling, and many small streams have cut into the underlying chalky bedrock (fig. 5). Trees grow along these streams in most places. Most of the association is fenced to permit grazing along with the cultivation of general field crops, which commonly are grown on the deeper soils. Most fields in this association are used for small grains, sweetclover, and other feed crops. The plowed fields are distinctly black and white because patches of light-colored, gravelly Eddy soils occur with the dark-colored Stephen soils.

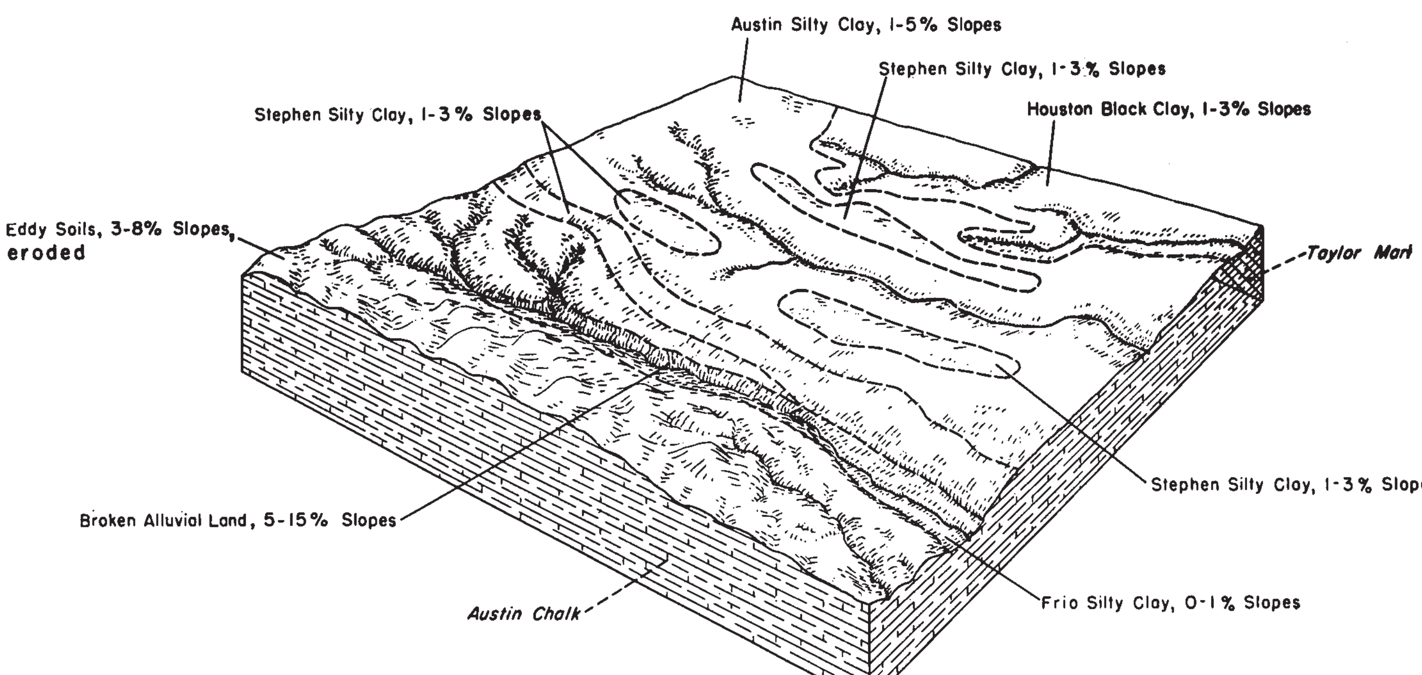

Figure 5.—**Relation of soils in soil association 4 to the underlying chalky bedrock. Eddy soils and Stephen silty clay soils are in soil association 4.**

The Eddy soils are gravelly clay loam. They are very shallow soils on gently sloping ridgetops or moderately steep side slopes. Chalk is commonly exposed in these soils. The more sloping areas are in native pasture. Many of the less sloping areas are in good pastures of King Ranch bluestem.

The Stephen soils are dark-brown, friable silty clay that absorbs water readily. They occur in the less sloping parts of this association, mainly in small valleys and in drainageways. These soils are limited in water-holding capacity because they are shallow to chalky bedrock. They are used mostly for small grains and for grazing of livestock.

The soils of this association are droughty, the chalky limestone is at the surface in some places, and the soil is never deeper than about 4 feet. Plants grow slowly during the hot summer. The soils of this association are best suited to small grains, sweetclover, and other cool-season crops.

A typical location of the main soils of this association is on the sloping, whiterock escarpment.

5. Austin-Houston Black association: Gently sloping blackland

This soil association consists of about 97,000 acres, or 16 percent of the county. It extends along U.S. Highway 77 from the northern boundary of the county to the southwestern boundary. This band is interrupted for about 3 miles by Chambers Creek and parts of soil associations 1, 9, and 4. The area is gently sloping, but sheet erosion is very noticeable in unprotected fields after rains.

This association is one of the main general farming areas in the county. Most of it is cultivated and produces good yields of field crops. It consists of average-sized farms on which the smooth soils are cultivated and the rougher ones along streams are in native pasture. In places light-colored areas of Stephen and Eddy soils occur in the black waxy fields and give them a black-and-white appearance when they are bare.

Austin soils are moderately deep, friable silty clay over chalk. They absorb water more readily than the Houston Black soils. They occur mainly in the western part of this association and are slightly higher than Houston Black soils (fig. 6). Austin soils are somewhat droughty and are used mainly for small grains, corn, and sweetclover. The cotton root-rot fungus causes considerable damage to cotton and sweetclover on these soils.

The Houston Black soils in this association are very dark gray, heavy clays that tend to crack severely when they dry after rains. These soils are over chalk in places in the western part of this association and are over a gray and yellow marl in the eastern part. Houston Black soils produce good yields of cotton, corn, and grain sorghum.

6. Houston Black-Houston association: Gently sloping and sloping blackland

This association is the largest in the county and amounts to about 104,000 acres, or 17 percent of the land area. It extends from the northern part of the county to the southern corner in a wide, broken band.

The association is dominantly used for general farming, and row crops common in the county are grown. When the fields are bare, black waxy soils can be seen on the nearly level and gently sloping areas and lighter colored soils on the stronger slopes. Much of the smoother part of this association is unfenced and is cultivated. Pasture is generally along the streams in areas impractical to cultivate.

Houston Black soils occur on gentle slopes. They are very dark gray, nearly black, heavy, deep clay soils that

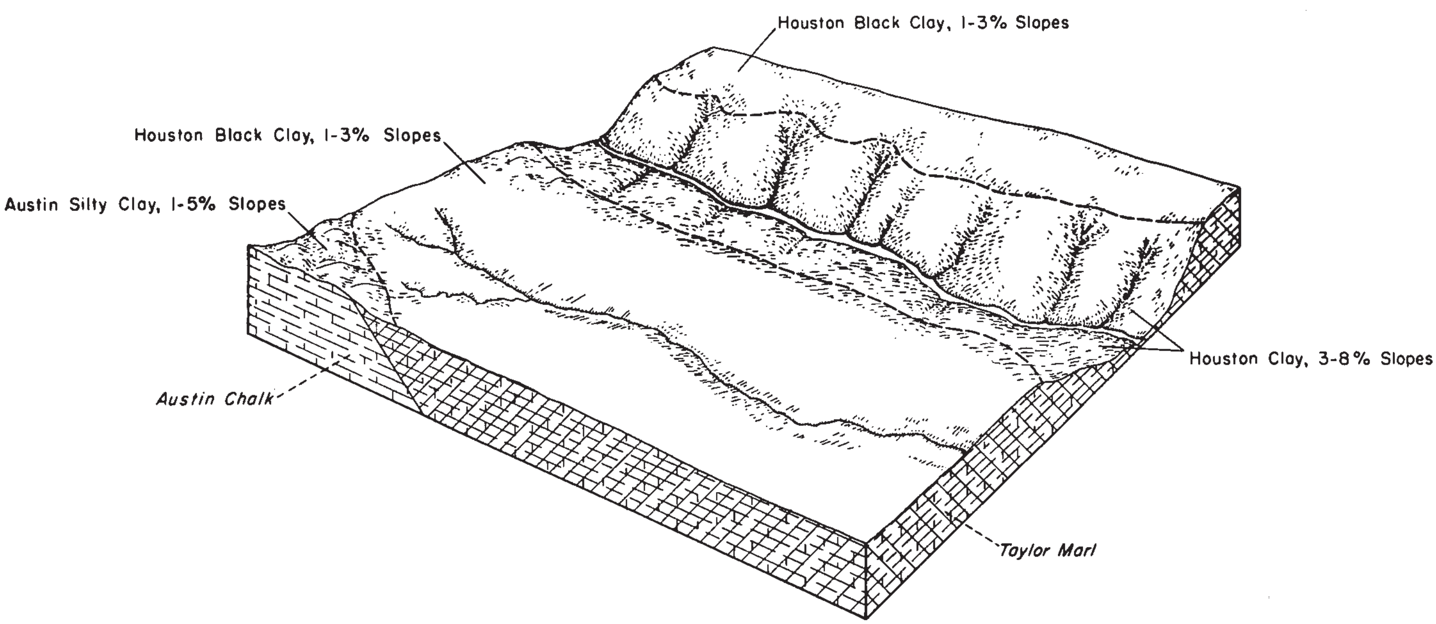

Figure 6.—**Geographical association of soils on sloping and gently sloping blackland. Austin silty clay and Houston Black clay soils are in soil association 5.**

produce good yields of cotton, corn, and grain sorghum. Most areas are cultivated. The dark-colored surface layer of these soils cracks severely when it dries. A compact layer, called a plowpan, usually forms in cultivated fields if they are plowed when they are wet. This layer slows the penetration of water and the growth of roots. Gray and yellow marl can be seen in deep cuts and ditches throughout this area.

Houston soils are dark olive-gray clays in sloping areas of natural drains. Stiff, olive clay is common at a depth of 10 to 15 inches. Erosion has removed much of the surface layer in many areas. Most areas of Houston soils were once cultivated, but in recent years they have been seeded to pasture. Runoff from the higher Houston Black soils has considerably damaged the more sloping Houston soils.

7. Wilson-Crockett association: Gently sloping grayland

This association surrounds Ennis in the east-central part of the county. It amounts to about 73,000 acres, or 12 percent of the county. The association is mainly a gently sloping area of light-colored, crusty soils and is used for general farming. When the fields are bare, light-colored soils can be seen. The surface layer ranges from dark heavy clay to light-gray fine sandy loam. Small native pastures with many mesquite trees are generally along the small streams.

Dominant in this association are the Wilson soils and the Crockett soils. The Wilson soils are gently sloping. The Crockett soils are on the narrow, short slopes between the lower Wilson soils and the flood plain (fig. 7). They also occur in small, isolated patches that lack uniformity in size and shape.

The Wilson soils make up about 85 percent of the association. They have a clay loam or fine sandy loam surface layer and a dark-gray heavy subsoil that is generally olive clay in the lower part. Most areas of these soils are cultivated and produce fair yields of cotton, corn, and grain sorghum.

The Crockett soils have a clay loam or fine sandy loam surface layer and a multicolored, mottled subsoil of dull red, gray, olive, and brown, blocky clay. These soils tend to crust badly during dry periods. Water penetrates them very slowly. Their surface layer is abruptly underlain by a blocky, tight claypan. After an extended wet period, the subsoil is often dry to a depth of 24 to 36 inches. These are some of the less productive soils in the county. On slopes they tend to erode readily. They have been extensively cultivated, but now they are mostly in unimproved, low-yielding pasture.

8. Houston-Sumter association: Rolling blackland

This association is in the eastern part of the county near the Trinity River and Walker Creek and along the lower part of Grove Creek. It amounts to about 25,000 acres, or 4 percent of the county. The soils are moderately sloping to moderately steep, and nearly all of them are severely eroded. Gullies are active and tend to eat back into the soils of higher, adjacent soil associations. Erosion has exposed the olive-gray or yellow clay subsoil in many places. Runoff is generally rapid.

Houston soils occupy the less sloping parts of this association. Their present surface layer is olive-gray or olive clay that grades to stiff clay at a depth of 8 to 14 inches. This surface layer is self-mulching, cracks when it dries, and contains many small, hard lumps of lime. The material below a depth of 2 to 4 feet is gray to yellow clay that is rich in lime and is commonly called marl.

The Sumter soils are generally more sloping than the Houston soils. They are more eroded than Houston soils and have a pale-olive or yellow, stiff clay surface layer.

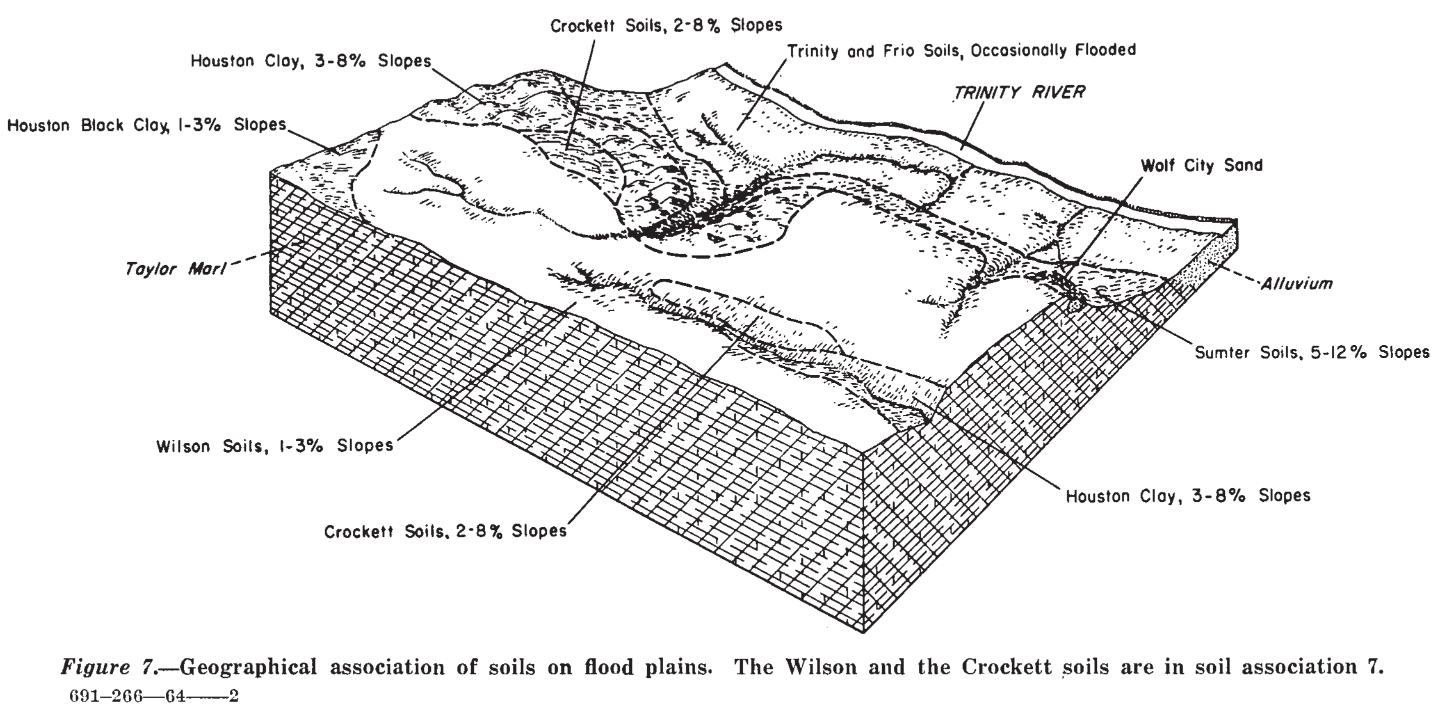

Figure 7.—**Geographical association of soils on flood plains. The Wilson and the Crockett soils are in soil association 7.**

About 10 percent of the association consists of the Lamar and the Bates soils. These soils are more granular and more permeable than the Houston and Sumter soils. However, because Lamar and Bates soils are sloping, they present about the same management problems as soils in the rest of the area.

The soils of this association are low in fertility because they are eroded. The surface layer dries out rapidly, and the soils are droughty. Most of this association has been cultivated, but it is now used mainly for grazing. Small areas of Houston soils are still cultivated and produce fair yields of small grains and sweetclover. These soils are best suited to grass, which protects them from further erosion. They provide grazing and are used mainly with the smooth, cultivated soils next to them. Most farm homes in this area have been abondoned and have either been destroyed or converted into storage places for hay.

9. Trinity-Frio association: Nearly level bottom land

This association consists of nearly level flood plains of major streams. It occupies 73,000 acres, or about 12 percent of the county. The width of the flood plains ranges from about 100 feet along the small streams to 3 or 4 miles along the Trinity River. Except for approximately 22,000 acres that are protected by levees, soils of this association are likely to be frequently damaged by flooding.

Trinity soils, in large areas, make up about five-sixths of this association. These soils are deep, dark-colored, nearly level clay. The Frio soils are deep, brown, and crumbly. They are better drained than Trinity soils and take in water more readily. Most areas of Frio soils are along the smaller streams and are less than 40 acres in size.

Nearly level areas of these soils that are protected from frequent floods are used mainly for row crops. High yields of cotton, corn, and grain sorghum are produced. Some fields are used for alfalfa and produce excellent yields. Many fields that are likely to be flooded are used mainly for grazing and for hay crops of johnsongrass and bermudagrass.

The lower lying areas and areas along stream channels are mostly in hardwoods and are subject to frequent flooding.

Descriptions of the Soils

This section describes in nontechnical language the soil series (groups of soils) and single soils (mapping units) of Ellis County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information of any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How Soils Are Named, Mapped, and Classified," not all mapping units are members of soil series. Broken alluvial land, Clay pits, Slickspots, and other miscellaneous land types do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

A soil symbol in parentheses follows each mapping unit and identifies that unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit and range site in which this soil has been placed. The page on which the capability unit is described can be found readily by referring to the "Guide to Mapping Units, Capability Units, and Range Sites" at the back of the report.

Soil scientists, teachers, engineers, and others who want detailed information about soil series should turn to the section "Formation and Classification of Soils." Many terms used in the soil descriptions and in other sections of the report are defined in the Glossary.

Austin Series

In the Austin series are well-drained, moderately deep, friable silty clays on the prairie. These soils are gently sloping to sloping and are well dissected by natural drains.

The dark grayish-brown to grayish-brown surface layer is about 16 inches thick. It has subangular blocky to granular structure and is hard when dry and firm but crumbly when moist. In places this layer contains a few fragments of slightly weathered, white chalk or chalky limestone.

The subsoil is pale brown and about 18 inches thick. It has a strong, subangular blocky to granular structure. Water and plant roots penetrate the subsoil readily. In places this layer contains many fragments of white chalk.

The parent material is chalky marl weathered from the Austin formation. The depth to bedrock ranges from 20 to about 50 inches and is greatest in small valleys and on concave foot slopes.

The Austin soils in this county are only in the area where the Austin formation crops out in the west-central part. These soils are thinnest along the western part of the area, where they are closely associated with the Eddy soils. They are thickest in the eastern part, where they are closely associated with the Houston Black clay soils. The Austin soils have developed under big bluestem, little bluestem, Indiangrass, and other tall grasses (*4*).

Austin soils occur with and somewhat resemble the Eddy and Stephen soils, but are deeper and contain fewer chalky fragments. They are shallower, browner, and less clayey than the Houston Black clay soils and are more granular and more sloping.

Austin silty clay, 1 to 3 percent slopes (AuB).—This is a moderately deep soil; it averages about 36 inches in thickness but is as much as 50 inches thick in some places. Areas mapped as this soil include as much as 5 percent of Stephen silty clay, 1 to 3 percent slopes, and as much as 5 percent of Houston Black clay, 1 to 3 percent slopes.

This soil is well suited to cultivated crops and produces good yields of all field crops common in the county. Because it is granular and well drained, this soil warms up early in the spring. It dries soon after rains, is easily cultivated, and is favored for growing early corn. It is well suited to Coastal bermudagrass (fig. 8),

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

Soil	Area	Extent
	Acres	*Percent*
Austin silty clay, 1 to 3 percent slopes	45, 047	7. 4
Austin silty clay, 3 to 5 percent slopes, eroded	16, 000	2. 6
Austin silty clay, 5 to 8 percent slopes, eroded	4, 100	. 7
Bates fine sandy loam, 3 to 5 percent slopes, eroded	100	[1]
Bates-Lamar complex, 5 to 12 percent slopes, eroded	250	[1]
Brackett and Austin soils, 2 to 5 percent slopes, eroded	1, 051	. 2
Broken alluvial land	3, 708	. 6
Burleson clay, 0 to 1 percent slopes	1, 486	. 2
Burleson clay, 1 to 3 percent slopes	3, 751	. 6
Burleson clay, depressional	316	[1]
Burleson clay, terrace, 0 to 1 percent slopes	8, 035	1. 3
Burleson clay, terrace, 1 to 3 percent slopes	4, 410	. 7
Clay pits	86	[1]
Crockett soils, 2 to 5 percent slopes, eroded	5, 782	. 9
Crockett soils, 3 to 8 percent slopes, severely eroded	511	. 1
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes	391	. 1
Eddy gravelly clay loam, 1 to 3 percent slopes	16, 889	2. 8
Eddy soils, 3 to 8 percent slopes, eroded	28, 757	4. 7
Eddy soils, 8 to 20 percent slopes	5, 411	. 9
Ellis and Houston clays, 3 to 5 percent slopes, eroded	5, 215	. 9
Ellis and Houston clays, 5 to 12 percent slopes, severely eroded	9, 421	1. 5
Frio loam	408	. 1
Frio silty clay, frequently flooded	6, 877	1. 1
Frio silty clay, occasionally flooded	2, 330	. 4
Gravel pits	548	. 1
Gullied land	1, 966	. 3
Houston clay, 1 to 3 percent slopes	8, 145	1. 3
Houston clay, 3 to 5 percent slopes, eroded	34, 363	5. 6
Houston clay, 5 to 8 percent slopes, eroded	18, 026	3. 0
Houston and Ellis clays, 1 to 3 percent slopes	16, 269	2. 7
Houston-Sumter complex, 5 to 8 percent slopes, severely eroded	17, 725	2. 9
Houston Black clay, 0 to 1 percent slopes	19, 871	3. 3
Houston Black clay, 1 to 3 percent slopes	112, 521	18. 4
Houston Black clay, terrace, 0 to 1 percent slopes	21, 610	3. 5
Houston Black clay, terrace, 1 to 3 percent slopes	15, 948	2. 6
Hunt clay, 0 to 1 percent slopes	643	. 1
Hunt clay, 1 to 3 percent slopes	3, 283	. 5
Lamar clay loam, 2 to 5 percent slopes eroded	452	. 1
Lamar clay loam, 5 to 12 percent slopes, eroded	1, 642	. 3
Lewisville association, 1 to 3 percent slopes	298	[1]
Lewisville association, 3 to 5 percent slopes, eroded	700	. 1
Lewisville association, 5 to 8 percent slopes, eroded	1, 037	. 2
Lewisville silty clay, 0 to 1 percent slopes	459	. 1
Lewisville silty clay, 1 to 3 percent slopes	3, 849	. 6
Lewisville silty clay, 3 to 5 percent slopes, eroded	4, 981	. 8
Lewisville silty clay, 5 to 8 percent slopes, eroded	5, 664	. 9
Lewisville soils, 5 to 8 percent slopes, severely eroded	4, 997	. 8
Payne clay loam, 0 to 2 percent slopes	606	. 1
Payne and Norge soils, 1 to 3 percent slopes	1, 345	. 2
Pratt loamy fine sand, terrace, 0 to 3 percent slopes	517	. 1
Slickspots	576	. 1
Stephen silty clay, 1 to 3 percent slopes	12, 505	2. 0
Stephen-Eddy complex, 1 to 3 percent slopes, eroded	6, 675	1. 1
Stephen-Eddy complex, 3 to 5 percent slopes, eroded	9, 375	1. 5
Sumter clay, 5 to 12 percent slopes, severely eroded	8, 686	1. 4
Trinity clay, frequently flooded	45, 673	7. 5
Trinity clay, loamy substratum	969	. 2
Trinity clay, occasionally flooded	19, 434	3. 2
Trinity clay, wet	4, 093	. 7
Wilson clay loam, 0 to 1 percent slopes	2, 502	. 4
Wilson clay loam, 1 to 3 percent slopes	17, 959	2. 9
Wilson clay loam, 1 to 3 percent slopes, eroded	6, 439	1. 1
Wilson clay loam, terrace, 0 to 1 percent slopes	465	. 1
Wilson clay loam, terrace, 1 to 3 percent slopes	2, 139	. 4
Wilson fine sandy loam, 0 to 1 percent slopes	1, 357	. 2
Wilson fine sandy loam, 1 to 3 percent slopes	3, 256	. 5
Water	1, 120	. 2
Total	611, 020	100. 0

[1] Less than 0.1 percent.

Caucasian bluestem (fig. 9), and similar grasses. (Capability unit IIe-1, Rolling Blackland range site)

Austin silty clay, 3 to 5 percent slopes, eroded (AuC2).—From 50 to 75 percent of this soil, erosion has removed the darker part of the grayish-brown surface layer. This layer is lighter colored and thinner than the surface layer of the less sloping and less eroded Austin soils. Small gullies are fairly common, and a few gullies are uncrossable. In most places this soil receives runoff from higher lying soils. Areas mapped as this soil include about 3 percent of Austin silty clay, 5 to 8 percent slopes, and about 5 percent of Brackett and Austin soils, 2 to 5 percent slopes, eroded.

Because it is moderately shallow and is well drained, this soil is fairly droughty. It is best suited to small grains, sweetclover, and other cool-season plants that protect it during heavy rains in spring. (Capability unit IIIe-2; Rolling Blackland range site)

Austin silty clay, 5 to 8 percent slopes, eroded (AuD2).—This soil is about 24 to 30 inches thick. It is thinner and lighter colored than the less sloping Austin soils. Small gullies, a few fairly large ones, and areas of thin soil are common. Included in mapped areas of this soil are small areas of Austin silty clay, 3 to 5 percent slopes, eroded; of Stephen-Eddy complex, 3 to 5 percent slopes, eroded; and of Eddy soils, 3 to 8 percent slopes, eroded.

This soil is droughty because it is moderately shallow and runoff is rapid. Occasionally it can be cultivated for row crops, but most of the time it should be kept in small grains, sweetclover, or other close-growing crops that protect it from erosion. (Capability unit IVe-1; Rolling Blackland range site)

Figure 8.—Coastal bermudagrass hay on Austin silty clay, 1 to 3 percent slopes.

Figure 9.—Caucasian bluestem on Austin silty clay, 1 to 3 percent slopes.

Bates Series

Soils of the Bates series are dark grayish brown, loamy, and moderately sloping to moderately steep. These soils occur in the Bristol community on fairly rough relief.

The dark grayish-brown surface layer is about 9 inches thick. It has weak, blocky to granular structure and is friable when moist but sticky when wet.

The sandy clay loam subsoil is mottled dark brown and yellowish brown and has blocky structure. It is firm when moist and sticky when wet. It is about 27 inches thick and medium acid to strongly acid.

The parent material is very pale brown sandy clay loam and weakly cemented sandstone. It is medium acid.

Most Bates soils occur in sloping areas that are well dissected by streams. They have a fairly thin solum and are over sandstone in places.

Bates soils differ from Crockett soils in being friable in the upper part of the subsoil. Throughout their profile they are less crusty and not so tight as Crockett soils. Bates soils have a less friable subsoil and are less calcareous than the Lewisville association soils.

Bates fine sandy loam, 3 to 5 percent slopes, eroded (BaC2).—Erosion has removed most of the surface layer from 50 to 75 percent of this soil, and small but uncrossable gullies are present. This soil is about 60 inches thick. Areas mapped as this soil include small areas of Crockett soils, 2 to 5 percent slopes, eroded, and small areas of Bates-Lamar complex, 5 to 12 percent slopes, eroded.

This soil is suited to cultivated crops, but good management of crop residue is needed to control erosion and to maintain organic matter. The soil is acid and is not suited to crops that require much lime. (Capability unit IIIe-4; Grayland range site)

Bates-Lamar complex, 5 to 12 percent slopes, eroded (BcE2).—This complex is in strongly sloping to moderately steep areas that have well-defined water courses. About 55 percent of the complex is Bates fine sandy loam, about 30 percent is Lamar clay loam, and about 15 percent is other soils. Also in the complex are Lewisville soils, 5 to 8 percent slopes, severely eroded. All these soils occur in such an intricate pattern that it is not practical to separate them on a soil map of the scale used.

These soils are not suited to cultivated crops; they are suited to only limited grazing. Because they are sloping and gullied, these soils are best suited to native grasses. (Capability unit VIe-5; Grayland range site)

Brackett Series

In the Brackett series are shallow, crumbly silty clays on the whiterock prairie. They are gently sloping to moderately sloping and are well drained.

The light brownish-gray surface layer is about 7 inches thick. It has a weak, granular to fine, blocky structure and is hard and crusty when dry and firm but crumbly when moist.

The subsoil is pale brown to very pale brown and has strong, subangular blocky structure. It is about 12 inches thick.

The parent material consists of thin-bedded chalky marl that grades to hard chalk at a depth of 40 to 60 inches. In some severely eroded areas the chalky bedrock is exposed.

The Brackett soils are underlain by the Austin formation, which is in the west-central part of the county. They occur with the Austin, Eddy, and Stephen soils in fairly small areas along ridges. The Brackett soils have developed under mid and tall grasses.

Brackett and Austin soils, 2 to 5 percent slopes, eroded (BkC2).—These are shallow soils that occur on the end of ridges. The Brackett soils have a light brownish-gray surface layer. The surface layer of the Austin soils is grayish brown. Both soils have a pale-brown subsoil.

Their parent material is slightly weathered, hard, platy or shaly marl at a depth ranging from 15 to 30 inches.

The Brackett soils average about 18 inches in thickness; the Austin soils average about 26 inches. Both grade to chalky marl. Their hard chalky bedrock, however, is not near the surface as it is in the Stephen soils, but is at a depth of about 4 to 6 feet.

Below the subsoil in these soils, a layer of slightly hard, brittle, platy marl restricts the movement of water and the growth of roots. Most of the time these soils are either too wet or too dry for good plant growth. They are suited only to sod crops. These soils are rich in lime and, when dry, are loose and ashy. In places, after rains, they are seepy, but they soon dry and are droughty.

About 3 percent of areas mapped as these soils is Austin silty clay, 3 to 5 percent slopes, eroded, and 5 percent is Stephen-Eddy complex, 3 to 5 percent slopes, eroded. (Capability unit IVs–1; Chalky Ridge range site)

Broken Alluvial Land

Broken alluvial land occurs in valleys along small streams on the whiterock prairie. This land type generally is a long, narrow valley that, in places, has one or more stream channels cut into chalky bedrock. It is mainly wooded with oak and pecan trees.

Broken alluvial land (Br).—This land is on slopes of about 5 to 15 percent and is closely associated with the Austin, Eddy, and Stephen soils. These areas are mostly wooded and are eroded only in the many places where stream channels have cut into the chalky bedrock. The land is in long, narrow, wooded valleys in which the natural channel is constantly silted and scoured. The soil on the uneroded side slopes of these small valleys is more than 5 feet thick in most places, and in the old channel, it is as much as 15 feet thick.

The soils are deep, crumbly, calcareous silty clays. They are in sloping areas along streams in the whiterock part of the county. They are well drained and contain a few patches of gravel in stratified beds. This land is mainly in oak and pecan trees.

The very dark grayish-brown surface layer is about 26 inches thick. It grades to and is underlain by lighter soil material, which extends to a depth of about 46 inches. The surface layer has a strong, granular structure and is hard when dry but slightly firm to friable when moist. Water penetrates this layer easily.

Underlying the surface layer is yellowish-brown silty clay that has weak, granular structure. It is about 24 inches thick and is over slightly weathered alluvium.

The parent material consists of slightly weathered alluvium that has accumulated over chalk.

Broken alluvial land is darker than the Lewisville soils and is underlain by chalky bedrock. It is generally darker and much deeper than the Austin soils.

Areas mapped as Broken alluvial land contain small areas of Austin silty clay, 5 to 8 percent slopes, eroded; of Eddy soils, 8 to 20 percent slopes; of Stephen-Eddy complex, 3 to 5 percent slopes, eroded; and of Lewisville soils, 5 to 8 percent slopes, severely eroded.

This land is too steep for cultivation. It is suited to pasture, but grazing should be controlled. The wild vegetation should be maintained to prevent gullying. (Capability unit VIe–4; Rolling Blackland range site)

Burleson Series

In the Burleson series are very dark gray, deep, heavy clays that tend to crust. These soils are nearly level to gently sloping. They have a dense subsoil that takes in water very slowly.

The very dark gray surface layer is about 12 inches thick. It has blocky to massive structure and is very hard when dry and very firm when moist. It cracks when it dries, but the blocks between the cracks remain dense and hard.

The subsoil is dark-gray to olive-gray, dense clay about 30 inches thick. It is massive and takes in water very slowly. When it dries and cracks, however, moisture intake is increased because rainwater runs into the cracks.

The parent material is mainly weathered, old alluvium that is rich in lime. In most places where these soils occur on stream terraces, the parent material is over water-bearing, stratified sand and gravel. Many gravel pits are in these areas.

The Burleson soils are deepest where they occur in large areas. The underlying sand and gravel in most places contain water at a depth of 10 to 15 feet. The higher lying soils grade to clayey marl and are not underlain by water-bearing sand or gravel as are most Burleson soils on terraces.

Burleson soils are noncalcareous and are more dense than the Houston Black clays on the terraces. They are more clayey in the surface layer than the Wilson soils.

Burleson clay, 0 to 1 percent slopes (BuA).—This nearly level soil is on upland ridges. It has good surface drainage because it occupies fairly narrow areas. It is about 50 inches thick over clayey marl. Included in areas mapped as this soil are small areas of Wilson clay loam, 0 to 1 percent slopes; of Houston Black clay, 0 to 1 percent slopes; of Hunt clay, 0 to 1 percent slopes; and of Burleson clay, 1 to 3 percent slopes.

This soil is suited to cultivated crops and produces good yields of most crops common in the county. The surface layer is usually deficient in lime and should be tested before seeding alfalfa, sweetclover, or similar crops. (Capability unit IIs–2; Grayland range site)

Burleson clay, 1 to 3 percent slopes (BuB).—This soil is on gently sloping ridges on uplands and is about 40 inches thick over clayey marl. It has good surface drainage. Included with this soil are small areas of Wilson clay loam, Hunt clay, and Houston Black clay, and of less sloping Burleson clay soils.

This soil is suited to cultivated crops. The surface layer is usually too low in lime for sweetclover and similar crops. Practices are needed to control erosion, and good management of crop residue is needed to control surface crusting and to prevent plowpans. (Capability unit IIIe–1; Grayland range site)

Burleson clay, depressional (By).—This soil is in slight depressions that have poor surface drainage. These areas tend to be ponded after rains. The soil is about 60 inches thick. Mapped areas include small areas of Burleson clay, terrace, 0 to 1 percent slopes, and small areas of Wilson clay loam, terrace, 0 to 1 percent slopes.

This soil is suited to cultivated crops, but surface drainage is needed to prevent ponding. Because the soil tends to remain wet and cold in spring, early seeding may be delayed. (Capability unit IIIw-1; Grayland range site)

Burleson clay, terrace, 0 to 1 percent slopes (BtA).—This soil is about 60 inches thick. Surface drainage is slow but is adequate for crops. Mapped areas of this soil include small areas of Burleson clay, terrace, 1 to 3 percent slopes; of Wilson clay loam, terrace, 0 to 1 percent slopes; and of Houston Black clay, terrace, 0 to 1 percent slopes.

This soil is suited to cultivated crops and produces good yields of most field crops common in the county. It needs good management that controls surface crusting and plowpans. Flat areas may remain too wet and too cold in spring for good growth of crops. Because in places this soil does not have sufficient lime for good yields of alfalfa and sweetclover, it should be tested before seeding these crops. (Capability unit IIs-2; Grayland range site)

Burleson clay, terrace, 1 to 3 percent slopes (BtB).—This soil is about 50 inches thick and is better drained than the less sloping Burleson soil. Mapped areas of this soil include small areas of Houston Black clay, terrace, 1 to 3 percent slopes; of Burleson clay, terrace, 0 to 1 percent slopes; and of Wilson clay loam, terrace, 1 to 3 percent slopes.

This soil is suited to cultivated crops and produces good yields of most crops common in the county. It needs good management that controls erosion and eliminates surface crusting and plowpans. In places this soil is deficient in lime and should be tested before seeding alfalfa, sweetclover, and similar crops. (Capability unit IIIe-1; Grayland range site)

Clay Pits

This miscellaneous land type consists of areas that have been disturbed by digging clay for bricks and by digging borrow pits for road fill material.

Clay pits (Cp).—Clay pits account for about 86 acres in the county and occur mostly in the eastern part. Clay is dug from the Taylor formation and is used for making brick at Ferris and Palmer. The pits are located mainly on strong slopes adjacent to the brickyards. Included with Clay pits are borrow pits along the Interstate highways where material has been excavated to build overpasses and other structures that require fill material. Except in pits where material is dug for brickmaking, most clay pits in the county contain water.

Clay pits occur on Houston, Houston Black, Sumter, Wilson, and similar soils. Because they are in small areas not suited for agriculture, these pits were not assigned a capability unit nor a range site.

Crockett Series

In the Crockett series are grayish-brown, moderately deep clay loams and fine sandy loams that have a dense clay subsoil. The soils are gently sloping to sloping and crust severely. Because they take in water very slowly, runoff is rapid and erosion is likely.

The grayish-brown surface layer is about 5 inches thick. It has a weak, granular structure and is hard when dry but friable when moist.

The subsoil is a brown to gray, dense claypan that is mottled with yellowish red to olive yellow and is about 30 inches thick. It has blocky structure or is massive, and it takes in water very slowly.

The parent material is weathered, clayey marl. It is moderately rich in lime and, in places, contains many rounded, hard pebbles.

The Crockett soils are thickest in the nearly level areas and are thinnest in the sloping areas. In the more sloping areas the surface layer ranges from clay loam to fine sandy loam.

Crockett soils have a lighter colored surface layer than the Wilson soils. They have a mottled brown, yellowish-red, and olive-yellow subsoil whereas the Wilson soils have a dark-gray subsoil.

Crockett soils, 2 to 5 percent slopes, eroded (CrC2).—Erosion has removed the original surface layer from about 50 percent of the area occupied by these soils. The present surface layer, combined with the subsoil, is generally about 42 inches thick. Mapped areas of these soils include about 8 percent of Wilson clay loam, 1 to 3 percent slopes, eroded.

These soils are droughty and poorly suited to cultivated crops. They produce only fair yields of the field crops common in the county. The content of lime is too low for alfalfa, sweetclover, and similar crops. (Capability unit IVe-2; Grayland range site)

Crockett soils, 3 to 8 percent slopes, severely eroded (CrD3).—These soils are on convex slopes and are severely damaged by erosion. They are about 30 inches thick, and areas where the surface soil is removed are common. Areas mapped as these soils include about 5 percent of Crockett soils, 2 to 5 percent slopes, eroded, and about 5 percent of Houston clay, 5 to 8 percent slopes, eroded.

These soils are not suited to cultivated crops. They should be kept in permanent vegetation, but yields of pasture are poor. (Capability unit VIe-5; Grayland range site)

Dougherty Series

Soils of the Dougherty series are grayish-brown loamy fine sands on low benches above the flood plain of the Trinity River and other streams.

The surface layer is slightly acid and is about 20 inches thick. In most places it is grayish brown in the upper part and lighter colored in the lower part. Wooded areas of these soils are very dark grayish brown in the upper part of the surface layer, which ranges from 18 to 32 inches in thickness. The surface layer is subangular blocky to single grain and is loose when dry and very friable when moist.

The sandy clay loam subsoil is yellowish red or reddish brown. It has weak, subangular blocky structure and is friable when moist and sticky when wet. This layer is moderately permeable and is about 30 inches thick.

The parent material is neutral to alkaline, sandy alluvium that washed from sandy areas in the Trinity River watershed.

All areas of Dougherty soils in the county occur in the southeastern corner, near the Trinity River. They are mapped in a single unit with Stidham soils. Dougherty soils have a finer textured subsoil than Pratt soils. They are coarser textured and have a less dense subsoil than the Wilson soils.

Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes (DsB).—These soils are slightly undulating and are about 60 inches thick. Their surface layer is loose when dry. Areas mapped as these soils include small areas of Wilson fine sandy loam, 0 to 1 percent slopes.

These soils are suited to cultivated crops that grow well in sandy soils. They need good management of crop residue if they are to maintain their supply of organic matter. They are neutral to slightly acid and produce good yields. (Capability unit IIe-3; Grayland range site)

Eddy Series

In the Eddy series are dark grayish-brown, thin gravelly clay loams on uplands. These soils are on gently sloping to moderately steep breaks and are underlain by chalk, or whiterock, in the western part of the county. Eddy soils are locally called whiterock soils (fig. 10).

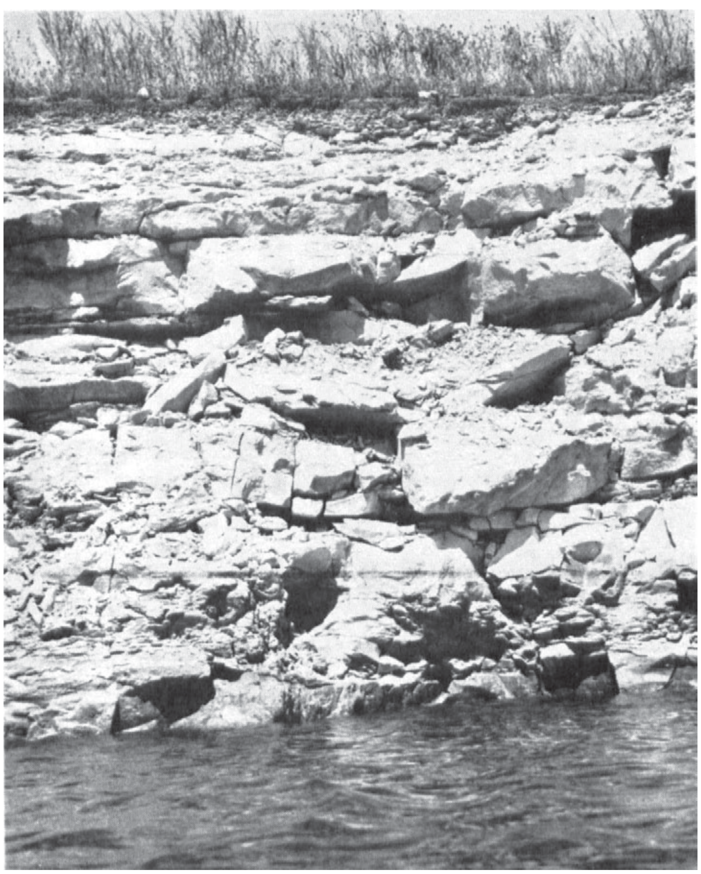

Figure 10.—**Eddy gravelly clay loam over Austin chalk.**

The dark grayish-brown gravelly clay loam surface layer is about 6 inches thick. It has granular structure and is hard when dry but friable when moist. About 25 percent of the surface layer is fragments of white chalk, which commonly slake to a loose white mass on the surface of the plowed soil.

White chalky bedrock underlies the surface layer at a depth of 8 inches or less. The upper part of the chalky bedrock is fractured in about half of the area, and plant roots penetrate into the cracks. Pasture on Eddy soils is mostly short grasses and mesquite (*12*). The Eddy soils are slightly higher than most other soils of the county.

Eddy soils occur close to the Austin and Stephen soils, but those soils are darker, deeper, and less sloping than Eddy soils and contain fewer chalk fragments. In areas mapped as Eddy soils along wooded streams, there are areas of Broken alluvial land. This land is darker, deeper, and more clayey than Eddy soils. Along the whiterock escarpment Eddy soils adjoin the Ellis soils, which are dense, olive clays. Along the eastern side of the Eddy-Stephen association, small areas of Eddy soils occur in larger areas of the darker and deeper Houston Black clay soils.

The surface layer of the Eddy soils commonly is dark grayish brown, but in the areas where chalk fragments are more numerous, it is light brownish gray. Because of chalk fragments on the surface and outcrops of chalky bedrock, many of the more eroded areas are almost white. The thickness of these soils ranges from about 4 to 8 inches, and the amount of chalk in the profile ranges from 10 to about 40 percent by volume. However, these soils produce fair yields of grasses (fig. 11).

Figure 11.—**King Ranch bluestem pasture on Eddy gravelly clay loam, 1 to 3 percent slopes.**

Eddy soils are well drained. These thin soils dry out when water trickles through cracks in the bedrock or seeps down the slope. Cracks in the bedrock make digging stock ponds impractical. To get a dependable supply of water, it is usually necessary to drill wells 600 to 800 feet through the chalk into the water-bearing Woodbine sand. These thin, droughty soils are rich in lime.

Figure 12.—Area representative of Eddy soils.

Eddy gravelly clay loam, 1 to 3 percent slopes (EcB).—This soil is on broad, gently sloping ridgetops in the whiterock area of the county (fig. 12). The surface layer is generally about 6 inches thick over chalky bedrock, but it ranges from 4 to 8 inches in thickness. The use of farm implements is difficult in areas where this soil is thinnest. Areas mapped as this soil include as much as 10 percent of Eddy soils, 3 to 8 percent slopes, eroded, and as much as 5 percent of Stephen-Eddy complex, 1 to 3 percent slopes, eroded.

This soil is suited to only occasional cultivation. Because it is shallow and droughty, small grains, sweetclover, and similar cool-season crops are best suited. (Capability unit IVs–1; Chalky Ridge range site)

Eddy soils, 3 to 8 percent slopes, eroded (EdD2).—This sloping soil is thinner than Eddy gravelly clay loam, 1 to 3 percent slopes, and contains more fragments of chalk. Thickness ranges from 2 or 3 inches on knolls to about 8 inches in small drainageways between ridges. Areas mapped as this soil include as much as 5 percent of Eddy soils, 8 to 20 percent slopes, and not more than 8 percent of Stephen-Eddy complex, 3 to 5 percent slopes, eroded.

This soil is not suited to cultivated crops, and grazing must be controlled. (Capability unit VIe–3; Chalky Ridge range site)

Eddy soils, 8 to 20 percent slopes (EdF).—This strongly sloping to moderately steep soil is generally on breaks and short escarpments. Erosion has exposed bedrock in some places, but in others soil has accumulated and is as much as 15 inches thick. These soils are commonly on benches with narrow ledges of chalk cropping out. Most of these areas are in scrubby Shumard oak. Areas mapped as this soil include as much as 10 percent of Eddy soils, 3 to 8 percent slopes, eroded. Areas of this soil adjacent to drainageways include about 3 percent of Broken alluvial land, and those along the western side of the whiterock area include as much as 3 percent of Ellis and Houston clays, 5 to 12 percent slopes, severely eroded.

Roots of perennial grasses and trees extend into crevices in the bedrock, but most roots spread laterally through the chalky rubble.

This soil is not suited to cultivated crops, and grazing must be controlled. Because it has a woody cover and is isolated, it is well suited to wildlife. (Capability unit VIIe–1; Chalky Ridge range site)

Ellis Series

The soils of the Ellis series are gently sloping to moderately steep, olive clays that are shallow to shale. They are dense and very slowly permeable. Because they are sloping and clayey, these soils take in water very slowly and have very rapid runoff.

The olive surface layer is about 7 inches thick. Its structure ranges from weak and blocky to massive. It is extremely hard when dry and extremely firm when moist. When the surface layer dries, it cracks severely, but the blocks between the cracks remain dense and hard. Gypsum crystals accumulate on the surface after rains.

The subsoil is dense, olive clay that contains many gypsum crystals and takes in water very slowly. This layer ranges from about 8 to 18 inches in thickness. It is blocky to massive and is extremely hard when dry and extremely firm when moist. In places the subsoil contains many pebbles.

The parent material is slightly altered, olive-yellow and gray, shaly clay. This layer grades abruptly to shale of the Eagle Ford formation. (See fig. 2, p. 3.)

The Ellis soils are thinnest on moderately steep slopes and are fairly gravelly on steep slopes. In areas where erosion is active, shale is exposed. These soils commonly have a white residue from gypsum on the surface, as well as a few hard fragments of brown limestone. Slickspots are common on these soils (fig. 13).

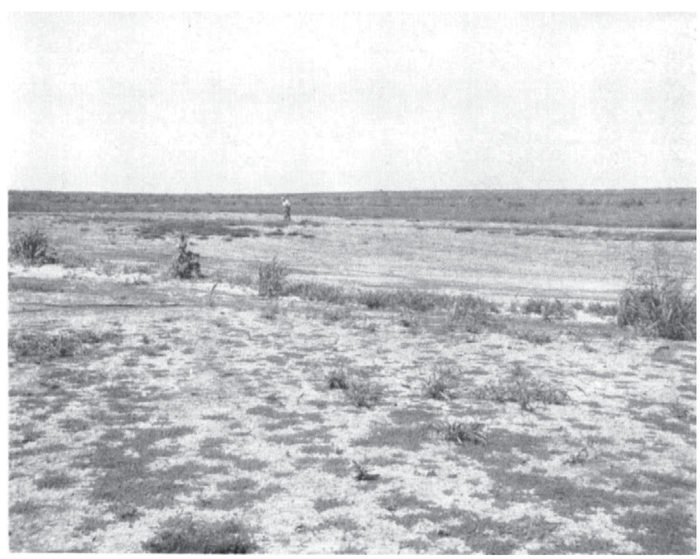

Figure 13.—Slickspot in Ellis soil. White salty slickspot is near the center where no plants are growing.

Most slickspots have such a large content of salts that most crops cannot grow.

Ellis soils are shallower, more olive colored, and less crumbly than the Houston and Sumter soils. They are thinner, lighter in color, and much firmer than Houston Black soils.

Ellis and Houston clays, 3 to 5 percent slopes, eroded (EhC2).—Erosion has removed the original dark surface layer from about 50 percent of the area of these moderately sloping soils.

In most places these soils are about 18 inches thick, but in some areas they are deeper than 25 inches to shale. They have many small gullies.

These soils are poorly suited to cultivated crops and should be kept under a continuous cover of small grains, sweetclover, or a similar close-growing crop. These soils are thin and droughty and produce poor yields of warm-season crops. Pasture requires good management that prevents the invasion of cactus and mesquite (fig. 14). (Capability unit IVe-3; Shaly Hardland range site)

Figure 14.—**Cactus and mesquite invading an overgrazed pasture on Ellis and Houston clays.**

Ellis and Houston clays, 5 to 12 percent slopes, severely eroded (EhE3).—These severely eroded soils have thin spots and many uncrossable gullies (fig. 15). Generally, these soils are about 14 inches thick and in places contain many pebbles. In some places, however, they are deeper than 25 inches to shale. Shale is exposed in severely eroded areas. Areas mapped as these soils include about 5 percent of Sumter clay, 5 to 12 percent slopes, severely eroded, and about 5 percent of Ellis and Houston clays, 3 to 5 percent slopes, eroded.

These soils are not suited to cultivated crops and should be kept under a permanent cover of plants that are tolerant of drought. They are best suited to native grasses, but grazing should be controlled. (Capability unit VIe-1; Shaly Hardland range site)

Figure 15.—**Side of a gully in Ellis and Houston clays.**

Frio Series

In the Frio series are dark grayish-brown, granular silty clay and loamy soils on the flood plain. Although these soils are nearly level, they are well drained because they have a porous subsoil. Low areas are subject to flooding.

The dark grayish-brown to very dark grayish-brown surface layer is about 12 inches thick. It has granular structure and is hard when dry and firm but crumbly when moist. In most places this layer contains strata of moderately coarse materials.

The subsoil is dark grayish brown to brownish gray, is granular, and is about 30 inches thick. It is very hard when dry and very firm but crumbly when moist. Water penetrates the subsoil with ease. In most places this layer contains strata of sandy materials.

The parent material is strongly calcareous, water-laid materials. In places it grades to stratified sand and gravel at lower depths.

Most areas of Frio soils in the county are silty clay, but a few are loam. The loam is deeper and better drained than the finer textured soils.

Frio soils occur on the flood plain over water-laid materials whereas the Austin soils occur on the uplands over chalky bedrock. Frio soils have a surface layer similar to that in Lewisville soils, which occur on slopes along streams. Frio soils are less clayey than the Trinity soils.

Frio loam (0 to 1 percent slopes) (Fl).—The surface of this nearly level, well-drained soil is somewhat wavy. This soil is about 60 inches thick. Areas mapped as this soil contain as much as 10 percent Frio silty clay, occasionally flooded.

This soil is well suited to cultivated crops, and only good management is needed to produce top yields of all crops common in the county. (Capability unit I-1; Bottomland range site)

Frio silty clay, frequently flooded (Fr).—This soil is in low areas on the flood plain. It is about 50 inches thick, and its surface is more wavy than that of Frio silty clay, occasionally flooded. Areas mapped as this soil contain as much as 10 percent Trinity clay, frequently flooded.

Because it is flooded frequently, this soil is not suited to cultivated crops. It produces excellent yields of pasture plants and should be used for permanent pasture. (Capability unit Vw-1; Bottomland range site)

Frio silty clay, occasionally flooded (Fs).—This soil is well drained. It is about 50 to 70 inches thick and is slightly undulating in places. Areas mapped as this soil contain as much as 5 percent of Trinity clay, occasionally flooded.

This soil is well suited to cultivated crops and needs only good management to produce top yields of all crops common in the county. Because it is well drained and fertile, it is excellent for pasture (fig. 16). (Capability unit I-1; Bottomland range site)

***Figure 16.*—Coastal bermudagrass pasture on Frio silty clay. The trees are native pecan trees.**

Gravel Pits

Gravel pits occur in small areas, mainly along streams where gravel has been dug for use in local construction. Many areas of this land type are abandoned and are growing up in native plants.

Gravel pits (Gp).—Most of these pits are only a few acres in size. They occur mainly along streams in Lewisville, Houston Black, Payne, Trinity, Frio, Wilson, and similar soils. Many of the older pits are partly abandoned and are growing up in willows, briers, grapevines, cattails, and other wild plants (*12*). Springs and seeps are common in these areas. (Capability unit VIIe-2; no range site assigned)

Gullied Land

Gullied land consists of areas so severely eroded and so dissected by gullies that they cannot be farmed. Unless these areas are stabilized, they will spread and damage adjacent soils.

Gullied land (Gl).—This land type consists of severely gullied clayey soils. The gullies are 10 to 30 feet deep and 30 to 150 feet wide. The original surface layer has been eroded from most of the area, and the present surface layer is mainly subsoil material and parent material. The soil material is calcareous in most places and is suited to plants that require large amounts of lime. In the eroded areas gullies have cut well into the underlying marl or shale. Drops, chutes, drop inlets, and similar grade-stabilization structures can be used in these clayey areas to help stabilize them and to prevent gullies from cutting into higher lying soils.

These areas are best suited as wildlife habitats. Fencing prevents livestock from grazing until vegetation is established. Firebreaks can be made by plowing a border strip around the areas. (Capability unit VIIe-2; Gullied Blackland range site)

Houston Series

In the Houston series are dark olive-gray, deep heavy clays. These soils are gently sloping to sloping and generally are eroded. They have a well-drained surface layer and are productive. Their subsoil is fine textured and takes in water slowly. These soils have developed under big bluestem, little bluestem, Indiangrass, and other tall native grasses. They are rich in lime.

The dark olive-gray and olive-gray surface layer is about 9 inches thick. It commonly has blocky structure and is very hard when dry and very firm when moist. The structure of the plow layer may be fairly granular. It cracks severely when it dries.

The subsoil is heavy clay, about 24 inches thick. It has blocky structure and is very hard when dry and very firm when moist. Because it cracks when it dries, the intake of water is increased.

The parent material is olive clay or clayey marl that is somewhat mottled with yellow. It hinders the movement of water through the soil. It has weak, blocky structure that grades to massive.

Houston soils are thinnest in the more sloping areas. They are more olive colored and finer textured in the western part of the county where they are underlain by the Eagle Ford shale. They are more limy in the lower part in places where they occur with the Sumter and Lewisville soils.

Houston soils are less dark, are thinner, and are more sloping than Houston Black soils. They are darker, thicker, and less sloping than Sumter soils.

Houston clay, 1 to 3 percent slopes (HcB).—This gently sloping soil is about 50 inches thick. It is in small areas. These areas include as much as 3 percent of Crockett soils, 2 to 5 percent slopes, eroded; as much as 5 percent Wilson clay loam, 1 to 3 percent slopes; or about 5 percent of Houston and Ellis clays, 1 to 3 percent slopes.

This soil is suited to cultivated crops and produces fair yields. In small areas it is used mostly for pasture and produces good yields. (Capability unit IIe-2; Rolling Blackland range site)

Houston clay, 3 to 5 percent slopes, eroded (HcC2).—The original surface layer has been removed by erosion from about 50 percent of this moderately sloping soil, and small gullies have formed. The soil is about 40 inches thick. Areas mapped as this soil include as much as 3 percent of Crockett soils, 2 to 5 percent slopes, eroded; about 3 percent Wilson clay loam, 1 to 3 percent slopes, eroded; or about 5 percent Ellis and Houston clays, 3 to 5 percent slopes, eroded.

This soil is suited to cultivated crops, but good management is needed to control erosion and to obtain good yields. It is best suited to feed crops or to small grains, sweetclover, or other close-growing crops. (Capability unit IIIe-3; Rolling Blackland range site)

Houston clay, 5 to 8 percent slopes, eroded (HcD2).—Erosion has removed the original surface layer from about 50 percent of this strongly sloping soil, and many small gullies and a few uncrossable ones have formed. The soil is about 30 inches thick. Areas mapped as this soil include about 5 percent of Sumter clay, 5 to 12 percent slopes, severely eroded, and about 5 percent of Houston-Sumter complex, 5 to 8 percent slopes, severely eroded.

This soil can be cultivated to row crops occasionally. It is best suited to small grains, sweetclover, and other close-growing crops that provide continuous cover that protects it from erosion. (Capability unit IVe-3; Rolling Blackland range site)

Houston and Ellis clays, 1 to 3 percent slopes (HmB).—These soils are olive heavy clays that are commonly over shale. About 60 percent of the area is Houston soils, about 35 percent is Ellis soils, and about 5 percent is other soils, mainly Houston Black clay and Burleson clay. Erosion is slight in about 75 percent of the area, but the rest contains many small gullies and some that are large enough to hinder plowing. These gently sloping soils generally take in water slowly to very slowly. If they have cracked after drying, they take in water rapidly until the cracks close. After the soils become wet, runoff is rapid.

The Houston soils in this unit differ somewhat from normal Houston soils. They are underlain by olive to dark-gray shale that is calcareous or noncalcareous. The shale is high in gypsum, and many gypsum crystals occur throughout the profile. These soils are less self-mulching and crack more severely when they dry than normal Houston soils and are somewhat less productive.

The olive surface layer is about 18 inches thick and is extremely hard when dry and very firm when moist. It has coarse, blocky structure and is commonly compacted by tillage. This layer cracks severely when it dries. The less eroded areas are somewhat more self-mulching than the more eroded areas, which commonly have a hard surface.

The subsoil is dense, olive clay that takes in water slowly. It has weak, blocky structure and is underlain by shale in most places.

The parent material is shaly clay underlain by slightly weathered shale.

The Houston soils of this unit are thinnest in the more sloping areas. They are strongly calcareous and less shaly than the Ellis soils but are more shaly than the normal Houston soils. Areas of Houston soils include small areas of Burleson clay, 1 to 3 percent slopes, and of Houston Black clay, 1 to 3 percent slopes.

The Ellis soils in this unit are dense, olive clay that is dominantly calcareous and is underlain by shale. These soils are less self-mulching than the Houston soils, and they crack more readily when they dry. They are rich in gypsum and contain a considerable amount of sodium. These salts cause numerous slickspots on the Ellis soils. A white residue of salts is common after rains in much of the area outside of the slickspots.

The olive surface layer is about 12 inches thick and commonly has very coarse, platy structure. The plates are very dense. This layer is extremely hard when dry and is extremely firm when moist.

The subsoil is dense, olive clay that takes in water very slowly. It is extremely hard when dry and extremely firm when moist. It grades abruptly to shale.

The parent material of Ellis soils is slightly weathered shale that is noncalcareous in about 50 percent of the areas tested.

Ellis soils of this unit are thinnest and more shaly in the more sloping areas. They are more shaly than the Houston soils and contain more gypsum and sodium. Areas of Ellis soils commonly contain small areas of Houston soils along foot slopes and in small valleys.

The soils of this unit are poorly suited to cultivated crops, and special management is needed if yields are to be profitable. Because they are somewhat wet and cold in spring, seeding is delayed. These soils are low in organic-matter content and have a narrow range of moisture in which they can be safely tilled. Stands of row crops are difficult to obtain. The soils are somewhat droughty for warm-season crops. In the more eroded areas continuous cover is needed to prevent further damage. The slickspots and gullies require special treatment if they are to maintain plant cover. (Capability unit IIIe-3; Shaly Hardland range site)

Houston-Sumter complex, 5 to 8 percent slopes, severely eroded (HsD3).—This complex is made up of about 50 to 65 percent Houston clay, severely eroded, and about 30 to 45 percent Sumter clay, severely eroded. The Houston clay occurs on the lower part of the slopes, and the Sumter clay is in a narrow band near the crest. Deep V-shaped gullies are about 30 to 200 feet apart in about 40 percent of the area. In the upper one-third of their reaches, the sides and bottoms of gullies are Sumter clay; in the lower two-thirds they are mostly Houston clay. The gullies are about 70 feet apart from center to center and have an average width of about 30 feet.

Most areas of this complex are abandoned pasture in which wild plants are stabilizing the gullies. The soils are well drained but are low in fertility because of erosion.

Mapped areas of this complex include as much as 5 percent of Ellis and Houston clays, 5 to 12 percent slopes, and about 2 percent of Trinity clay, which occurs on the wide bottoms of stabilized gullies, in their lower reaches.

Soils of this complex are not suited to cultivated crops. They are best suited to pasture of native bluestem, but grazing must be controlled. (Capability unit VIe-2; Gullied Blackland range site)

Houston Black Series

In the Houston Black series are nearly level to gently sloping, deep clays on uplands and terraces. These soils are moderately well drained and productive. They developed under big bluestem, little bluestem, Indiangrass, and other tall native grasses. They are rich in lime and, in places, contain a few chalk fragments or pebbles.

The very dark gray surface layer is about 16 inches thick. It has granular to blocky structure and is hard when dry and plastic when wet. This layer is self-mulching and cracks when it dries.

The subsoil has blocky structure and takes in water slowly. It is about 30 inches thick. In dry periods, cracks extend from the surface well into this layer.

The parent material varies and is weathered chalk, calcareous clay, clayey shale, or old alluvium, depending on the location in the county. All of these materials are rich in lime.

The Houston Black soils are thinnest in areas over chalky bedrock. In those areas they average about 50 inches thick over the chalk. They are thickest in areas underlain by old alluvium. In areas where shale is the parent material, these soils are browner than is normal for the series.

Houston Black soils are darker, deeper, and less sloping than Houston soils. They are darker, finer textured, and less sloping than Austin soils. Unlike the Austin soils, microrelief is generally pronounced in native pastures of Houston Black soils (fig. 17).

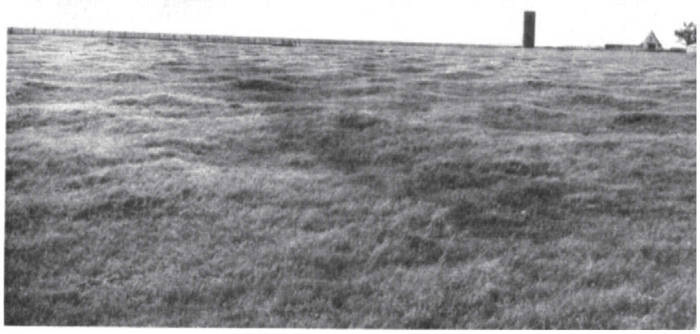

***Figure 17.*—Microrelief in Houston Black soil.**

Houston Black clay, 0 to 1 percent slopes (HaA).—This well-drained soil is about 85 inches thick. Areas mapped as this soil include small areas of Hunt clay, 0 to 1 percent slopes; of Houston Black clay, terrace, 0 to 1 percent slopes; of Wilson clay loam, 0 to 1 percent slopes; and of Houston Black clay, 1 to 3 percent slopes.

This soil is well suited to cultivated crops and produces high yields of field crops common in the county. Because it is nearly level and smooth, this soil is favored for cotton, corn, grain sorghum, alfalfa, and other crops. Good management of crop residue is needed (fig. 18) to improve the soil. (Capability unit IIs-1; Rolling Blackland range site)

Houston Black clay, 1 to 3 percent slopes (HaB).—This well-drained soil averages about 70 inches in thickness. Areas mapped as this soil include small areas of Houston Black clay, 0 to 1 percent slopes; of Hunt clay, 0 to 1 percent slopes; and of Wilson clay loam, 1 to 3 percent slopes.

This soil is well suited to cultivated crops and produces high yields of cotton, corn, grain sorghum, and other crops. Good management is needed to control

***Figure 18.*—Shredded stubble of grain sorghum on Houston Black clay, 0 to 1 percent slopes.**

erosion and to prevent a plowpan from forming. The more sloping areas need terraces (fig. 19) that can control the field water. Although about 17 percent of this soil has prominent rills and gullies after rains, the rills and gullies will be eliminated in a few years after terraces are built. (Capability unit IIe-2; Rolling Blackland range site)

***Figure 19.*—Terraces emptying onto bermudagrass waterway on Houston Black clay, 1 to 3 percent slopes.**

The Houston Black clay, terrace, soils consist of very dark gray, deep heavy clays in nearly level or gently sloping areas along streams. The native vegetation is tall grasses and scattered patches of hardwoods.

The very dark gray surface layer is about 30 inches thick. It is self-mulching, and the upper 4 to 6 inches is crumbly and loose when dry. Cracks are prominent during dry periods. A distinct plowpan has formed in fields that have been planted mostly to row crops. This is a compacted zone just below plow depth. It averages about 8 to 12 inches in thickness and has platy structure or is massive.

The subsoil is mainly olive gray, has blocky structure, and is about 30 inches thick. It is stiff when wet and is slowly penetrated by water. In places this layer contains gravel.

The parent material consists of calcareous, clayey material that is mainly old alluvium. In most places this layer grades to water-bearing stratified beds of sand and gravel at depths ranging from 10 to 30 feet. These beds are absent in places, but where they occur, they provide water for a shallow well.

Some areas of these soils are flat and slowly drained. In these areas plant growth is hindered because the soils are wet and cold during spring.

In most places the Houston Black clays on terraces are less sloping than the other Houston Black clays, which are underlain by chalk, shale, marl, or similar material.

Houston Black clay, terrace, 0 to 1 percent slopes (HbA).—This soil, which is about 60 inches thick, grades to limy parent material. Although surface drainage is slow in places, it is ample for cultivated crops. Mapped areas of this soil include small areas of Houston Black clay, 0 to 1 percent slopes; of Burleson clay, terrace, 0 to 1 percent slopes; and of Lewisville silty clay, 0 to 1 percent slopes. An area representative of this soil is shown in figure 20.

***Figure 20.*—Houston Black clay, terrace, 0 to 1 percent slopes, planted to cotton. Prominent tree in background is native pecan.**

This soil is well suited to cultivated crops. If managed well, it produces good yields of all crops generally grown in the county. It erodes only slightly if left unprotected. Continuous use for row crops and excessive tillage cause a plowpan to form, and the plowpan reduces water intake, increases runoff, and lowers crop yields. If it is poorly managed, this soil hardens and crusts on the surface. (Capability unit IIs–1; Rolling Blackland range site)

Houston Black clay, terrace, 1 to 3 percent slopes (HbB).—This gently sloping soil has good surface drainage. It is about 40 inches thick. Areas mapped as this soil include small areas of Houston Black clay, terrace, 0 to 1 percent slopes, and of Lewisville silty clay, 1 to 3 percent slopes.

Grain sorghum (fig. 21) and other crops that produce much residue add organic matter that helps to improve the soil.

***Figure 21.*—Grain sorghum on Houston Black clay, terrace, 1 to 3 percent slopes.**

This soil is well suited to cultivated crops. If it is managed well, it produces good yields of most crops grown in the county. Because it is sloping, this soil erodes if it is unprotected. Continuous row crops and excessive tillage cause a plowpan to form. Because surface drainage is good, young crops start well on this soil (fig. 22). (Capability unit IIe–2; Rolling Blackland range site)

***Figure 22.*—Young cotton on Houston Black clay, terrace, 1 to 3 percent slopes.**

Hunt Series

In the Hunt series are dark-gray, deep, clayey soils that have a noncalcareous surface layer. These soils are on nearly level to gently sloping uplands and are moderately well drained and productive. They developed under the tall native grasses that are common in the blackland, but they have a lower content of lime than Houston Black clays and similar dark soils.

The surface layer is about 16 inches thick. It has blocky structure and is hard when dry and very plastic when wet. The surface crusts after rains and cracks readily when it dries. The cracks increase absorption of rainfall because water runs into them.

The subsoil has blocky structure and takes in water slowly. It is about 36 inches thick and is underlain by marl. In long dry periods cracks extend from the surface well into the subsoil.

The parent material is weathered clayey marl or marl.

The Hunt soils occur in the east-central part of the county, where they are underlain by marl of the Taylor formation. Scattered over the surface in many places are numerous iron concretions and hard, rounded pebbles. In most areas the subsoil is mottled, pale olive, dark yellowish brown, and olive yellow. The surface layer of Hunt soils is similar to that of Houston Black clay soils but is noncalcareous. Hunt soils are more granular, more blocky, and less crusty than Burleson soils.

Hunt clay, 0 to 1 percent slopes (HuA).—This nearly level soil is moderately well drained. It is about 70 inches thick in most places. Areas mapped as this soil include small areas of Houston Black clay, 0 to 1 percent slopes, and of Hunt clay, 1 to 3 percent slopes.

This soil is well suited to cultivated crops and produces high yields of most field crops common in the county. Because it is nearly level, this soil is favored for cotton, corn, grain sorghum, and other cash crops. (Capability unit IIs–1; Rolling Blackland range site)

Hunt clay, 1 to 3 percent slopes (HuB).—This uneroded soil is about 50 to 60 inches thick and is moderately well drained. Areas mapped as this soil include small areas of Houston Black clay, 1 to 3 percent slopes; of Wilson clay loam, 1 to 3 percent slopes; and of Burleson clay, 1 to 3 percent slopes.

This soil is well suited to cultivated crops, but good management is needed to control erosion and to prevent a plowpan and a crust from forming. Yields of cotton, corn, grain sorghum, and similar crops are high. (Capability unit IIe–2; Rolling Blackland range site)

Lamar Series

In the Lamar series are moderately deep, crumbly, calcareous clay loams that are gently sloping to moderately steep. These well-drained soils developed in weakly consolidated, calcareous material under tall prairie grasses. They are mainly in old pastures that have grown up in coarse bunchgrasses, partridgepeas, and briers. Many native pecan trees grow along streams.

The grayish-brown to light olive-brown surface layer is about 16 inches thick. It has granular and subangular blocky structure and is hard when dry and friable when moist. Water penetrates this layer easily.

The subsoil is light brownish gray and has weak, blocky structure. It is about 20 inches thick and grades to a slightly bedded material that is rich in lime.

The parent material is strongly calcareous, somewhat sandy marl of marine origin. In places a layer of brown limestone about 3 to 5 inches thick occurs at a depth of 30 to 60 inches.

These soils are deepest on gently sloping ridgetops and at the foot of long slopes. They are more shallow in moderately steep areas.

The surface layer of Lamar soils is similar to that of Lewisville soils, which developed in sloping old alluvium. Lamar soils are not so dense and clayey as the Houston and Sumter soils.

Lamar clay loam, 2 to 5 percent slopes, eroded (LaC2).—This well-drained soil is on fairly narrow ridgetops. It is about 62 inches thick and is underlain by somewhat sandy marl. Areas mapped as this soil commonly include small areas of Houston clay, 3 to 5 percent slopes, eroded; of Lewisville silty clay, 3 to 5 percent slopes, eroded; and of Bates fine sandy loam, 3 to 5 percent slopes, eroded. On gently sloping ridgetops small areas of Wilson soils may also be included.

This soil is fairly well suited to cultivated crops but needs good management that controls erosion. It is best suited to small grains, sweetclover, and other cool-season crops. (Capability unit IVe–1; Rolling Blackland range site)

Lamar clay loam, 5 to 12 percent slopes, eroded (LaE2).—This strongly sloping to moderately steep soil is well dissected by natural drains in most places. It is about 40 inches thick and is underlain by somewhat sandy marl. Erosion has removed the grayish-brown surface layer from much of the area. Areas mapped as this soil commonly include small areas of Bates-Lamar complex, 5 to 12 percent slopes, eroded; of Houston-Sumter complex, 5 to 8 percent slopes, severely eroded; and of Sumter clay, 5 to 12 percent slopes, severely eroded.

This soil is not suited to cultivated crops. Grasses or other permanent cover can be grown, but grazing should be controlled. A good cover is needed to control erosion. (Capability unit VIe–4; Rolling Blackland range site)

Lewisville Series

In the Lewisville series are deep, crumbly, calcareous silty clays and loams on slopes along streams. These soils are well drained and in most places are underlain by beds of stratified sand and gravel. Shallow wells, springs, and gravel pits are common (fig. 23). Native pecan trees grow well on these soils.

The dark-brown surface layer is about 16 inches thick. It commonly has granular structure and is hard when dry and firm but crumbly when moist. Water penetrates this layer easily.

The subsoil is yellowish brown and is about 20 inches thick. It has strong, granular structure and grades from silty clay to sandy clay, sand, or gravel in most places. This layer contains many hard concretions of lime.

The parent material is weathered, strongly calcareous material deposited by water. Beds of stratified sand

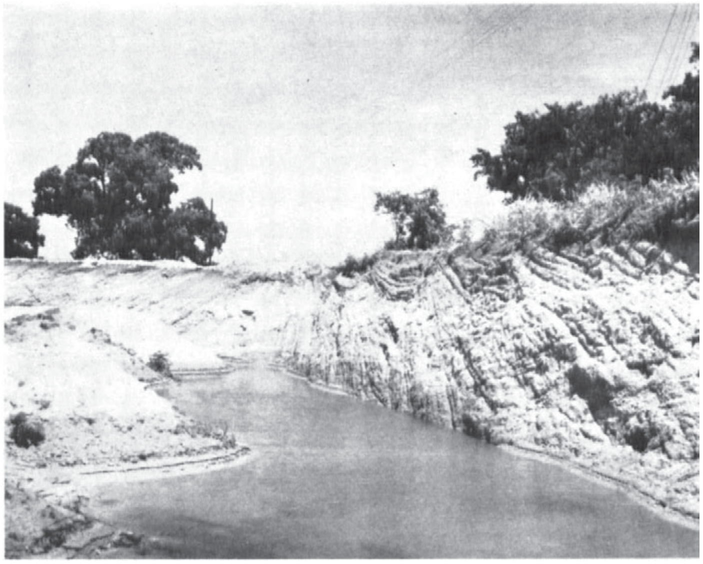

Figure 23.—Gravel pit in Lewisville soil.

and gravel are common at a depth of 5 to 20 feet in most places.

The Lewisville soils are thickest in the large, nearly level areas and thinnest on strong slopes.

Lewisville soils are more granular, browner, and more sloping than Houston Black clay, terrace, soils. They are browner and lower in content of clay than the Austin soils.

Lewisville association, 1 to 3 percent slopes (LwB).—The soils in this association are mostly Lewisville loam or clay loam, but Norge fine sandy loam or loam makes up about 15 to 30 percent. These well-drained, gently sloping soils are about 66 inches thick. They are underlain by sandy clay and are cut by a few small gullies. Mapped areas of this association include small areas of Payne clay loam, 1 to 3 percent slopes, and about 5 percent of Lewisville association, 3 to 5 percent slopes, eroded.

These soils are suited to cultivated crops, but protection from erosion is needed. They warm up early in spring but are somewhat droughty in hot, dry weather. (Capability unit IIe-1; Rolling Blackland range site)

Lewisville association, 3 to 5 percent slopes, eroded (LwC2).—The dominant soil in this association is Lewisville loam, but about 15 to 20 percent is a soil that is similar to Lewisville loam but has more sand in the subsoil than that soil. These moderately sloping, well-drained soils are on convex slopes and are about 60 inches thick. They are underlain by sandy clay. Erosion has removed part of the original surface soil and has caused a few gullies to form. Mapped areas of this association include about 5 percent Lewisville association, 1 to 3 percent slopes, and about 5 percent Lewisville silty clay, 3 to 5 percent slopes, eroded.

These soils are fairly well suited to cultivated crops, but good management of crop residue and cover crops is needed to control erosion. The soils are somewhat droughty in hot, dry weather and are best suited to small grains, sweetclover, and other cool-season crops. (Capability unit IIIe-2; Rolling Blackland range site)

Lewisville association, 5 to 8 percent slopes, eroded (LwD2).—The soils in this association are more sloping than those in Lewisville association, 3 to 5 percent slopes, eroded. They are about 44 inches thick and are underlain by sandy clay. Erosion has removed the darker part of the surface soil from about 50 percent of the area. Small gullies are fairly common, and a few cannot be crossed with farm machinery. Areas mapped as this soil include about 5 percent Lewisville association, 3 to 5 percent slopes, eroded, and about 5 percent Lewisville silty clay, 5 to 8 percent slopes, eroded.

These soils are suited to only occasional cultivation. Because they are droughty, they are best suited to small grains, sweetclover, and other cool-season crops. (Capability unit IVe-1; Rolling Blackland range site)

Lewisville silty clay, 0 to 1 percent slopes (LeA).—This nearly level, well-drained soil is about 70 inches thick and is underlain by sandy clay. Mapped areas of this soil include as much as 10 percent Houston Black clay, terrace, 0 to 1 percent slopes.

This soil is well suited to cultivated crops and produces high yields of all crops common in the county. It has granular structure throughout that enables it to warm up early in spring and that permits young crops to start growing rapidly. (Capability unit I-1; Rolling Blackland range site)

Lewisville silty clay, 1 to 3 percent slopes (LeB).—This gently sloping, well-drained soil is about 60 inches thick and is underlain by sandy clay. It is slightly eroded in places. Mapped areas of this soil include small areas of Houston Black clay, terrace, 1 to 3 percent slopes, and as much as 5 percent of Lewisville silty clay, 3 to 5 percent slopes, eroded.

This soil is well suited to cultivated crops. Because it is well drained, it produces good yields of early corn and other crops. (Capability unit IIe-1; Rolling Blackland range site)

Lewisville silty clay, 3 to 5 percent slopes, eroded (LeC2).—This moderately sloping soil is on convex slopes, is about 48 inches thick, and is underlain by sandy clay. Erosion has removed the original dark-brown surface soil in most places, and small gullies are common. Mapped areas include about 5 percent Houston clay, 3 to 5 percent slopes, eroded; about 2 percent Lewisville association, 3 to 5 percent slopes, eroded; and about 3 percent Lewisville silty clay, 5 to 8 percent slopes, eroded.

This soil is fairly well suited to cultivated crops but needs good management that controls erosion. It is best suited to small grains, sweetclover, and other cool-season crops. (Capability unit IIIe-2; Rolling Blackland range site)

Lewisville silty clay, 5 to 8 percent slopes, eroded (LeD2).—This strongly sloping soil is on convex slopes. It is about 40 inches thick and is underlain by sandy clay. Erosion has removed the original dark-brown surface soil in most places, and uncrossable gullies are common. Mapped areas include about 5 percent Lewisville silty clay, 3 to 5 percent slopes, eroded, and about 5 percent Houston clay, 5 to 8 percent slopes, eroded.

This soil is suited to only occasional cultivation. It is somewhat droughty and is subject to further erosion unless it is protected. It is best suited to small grains, sweetclover, and other cool-season crops. (Capability unit IVe–1; Rolling Blackland range site)

Lewisville soils, 5 to 8 percent slopes, severely eroded (LsD3).—This strongly sloping soil is about 36 inches thick and is underlain by sandy clay. Erosion has removed the original dark-brown surface layer in most places and has caused large, uncrossable gullies to form. Mapped areas of this soil include about 5 percent Lewisville silty clay, 5 to 8 percent slopes, eroded; about 5 percent Houston-Sumter complex, 5 to 8 percent slopes, severely eroded; and about 3 percent Sumter clay, 5 to 12 percent slopes, severely eroded.

This soil is not suited to cultivated crops. It is suited to grasses and other permanent cover, but grazing should be controlled. A good plant cover should be maintained at all times to control erosion. (Capability unit VIe–4; Gullied Blackland range site)

Norge Series

In the Norge series are brown to reddish-brown, deep clay loams and fine sandy loams that have a reddish sandy clay subsoil. These soils occur with the Payne and Lewisville soils, mostly along Chambers Creek.

The surface layer of Norge soils is about 6 inches thick. It has weak, granular structure and is hard when dry but friable when moist. This layer is about neutral in reaction.

The sandy clay subsoil is about 38 inches thick. It has weak, blocky structure and is very firm when moist and very hard when dry. This layer ranges from slightly acid to alkaline.

The parent material is sandy, old alluvium. Beds of stratified sand and gravel underlie about 40 percent of the area. These beds are generally calcareous.

Norge soils are redder than Payne and Lewisville soils. Their subsoil is not mottled like that in Payne soils.

In Ellis County, Norge soils are not mapped separately but are included with Payne and Norge soils, 1 to 3 percent slopes.

Payne Series

In the Payne series are dark grayish-brown, deep, slightly acid clay loams and fine sandy loams that have a dense subsoil and are nearly level to gently sloping. The surface layer crusts after rains, and the subsoil takes in water slowly. In Ellis County most of these soils are along Chambers Creek.

The dark grayish-brown surface layer is about 6 inches thick. It has weak, granular structure and is hard when dry and friable when moist. This layer grades abruptly to the subsoil.

The subsoil is dense clay mottled with yellowish red, reddish brown, and light olive brown. It is about 38 inches thick and is underlain by calcareous alluvium. It has blocky to massive structure and is very firm when moist. The subsoil ranges from slightly acid to alkaline.

The parent material is weathered, sandy old alluvium. In about 75 percent of the area, these soils are underlain by beds of stratified sand and gravel that generally are calcareous. The rest of their area is underlain by clayey marl.

Payne soils that have had much of the surface layer removed by erosion are dark yellowish brown. They are slightly undulating in places.

Payne soils are more blocky than Crockett soils and are less dense in the upper part of the subsoil. Their mottled subsoil is less dense than that in Wilson soils on terraces.

Payne clay loam, 0 to 2 percent slopes (PcA) —This nearly level to very gently sloping soil ordinarily is about 60 inches thick and is underlain by calcareous alluvium. Areas mapped as this soil include small areas of Wilson clay loam, terrace, 0 to 1 percent slopes; of Burleson clay, terrace, 0 to 1 percent slopes; and of Houston Black clay, terrace, 0 to 1 percent slopes.

This soil is well suited to cultivated crops and produces good yields. It is not suited to crops that require large amounts of lime. Good management of crop residue is needed to prevent crusting. (Capability unit IIIe–1; Grayland range site)

Payne and Norge soils, 1 to 3 percent slopes (PnB).—Payne and Norge soils are mapped together in this unit, but most areas are Payne clay loam. These soils are about 65 inches thick and are underlain by calcareous alluvium. In places the surface is slightly undulating. Areas mapped as these soils include small areas of Payne clay loam, 0 to 2 percent slopes; of Burleson clay, terrace, 0 to 1 percent slopes; of Wilson clay loam, terrace, 0 to 1 percent slopes; and of Houston Black clay, terrace, 0 to 1 percent slopes.

These soils are well suited to cultivated crops and produce good yields of crops that do not require large amounts of lime. Good management of crop residue is needed to prevent crusting. (Capability unit IIIe–1; Grayland range site)

Pratt Series

In the Pratt series are deep, slightly acid loamy fine sands that occur on terraces along the flood plain of the Trinity River in the eastern part of the county. In most places these soils are slightly undulating.

The dark-brown loamy fine sand surface layer is about 9 inches thick and has a weak, granular to single-grain structure. It is loose when dry and very friable when moist. This layer takes in water rapidly.

The subsoil is dark yellowish-brown to brownish-yellow, loose loamy fine sand, and it also takes in water rapidly. It is about 100 inches thick and is underlain by calcareous clay.

The parent material is acid, sandy alluvium that washed from sandy areas in the Trinity River watershed.

Pratt soils are low in organic matter and tend to blow when they are left unprotected. They are coarser and more yellow than Dougherty and Stidham soils and have a loose, coarser textured subsoil.

Pratt loamy fine sand, terrace, 0 to 3 percent slopes (PrA).—This nearly level to slightly undulating soil is more than 100 inches thick in most places. The surface layer is loose when it is dry. Mapped areas of this soil include small areas of Trinity clay, loamy substratum.

This soil is suited to cultivated crops of adapted varieties. It is slightly acid and is low in organic-matter content. Permanent cover is needed on the soil to maintain the content of organic matter and to prevent blowing. (Capability unit IIIs-1; Grayland range site)

Slickspots

Slickspots are a miscellaneous land type. They vary in size and contain so much salt or alkali that plants cannot grow.

Slickspots (Sc).—This miscellaneous land type occurs predominantly in depressions. The spots vary in size from less than 1 acre to as much as 40 acres. They are hard and clayey and contain a large amount of salt or alkali. (See fig. 13, p. 14.) In Ellis County slickspots occur in areas mapped as Ellis, Wilson, and other clayey soils. Slickspots less than 2½ acres in size are shown on the map by the symbol theta; large ones are delineated and are designated by the symbol Sc. Because they are generally in small areas and are not suited to agriculture, slickspots were not assigned a capability unit nor a range site.

Stephen Series

In the Stephen series are well-drained, shallow silty clays that contain a few chalky fragments in most places. These soils are gently sloping to moderately sloping and are well dissected with natural drains. They are on the whiterock prairie.

The dark grayish-brown surface layer is about 14 inches thick. It has moderate, medium, granular and fine, subangular structure and is hard when dry and firm when moist.

The subsoil is pale brown and contains a mass of chalky rubble or platy fragments several inches across. It is hard when dry and firm when moist.

The parent material is chalky marl underlain by Austin chalk. The depth to chalky bedrock ranges from about 8 to 24 inches.

In Ellis County all the Stephen soils are underlain by the Austin formation. They are shallowest in places where they occur close to the Eddy soils and are deepest in places where they occur near the Austin soils. They developed under side-oats grama, big bluestem, little bluestem, Indiangrass, and other mid and tall grasses.

Stephen soils are closely associated with the Austin and Eddy soils. They are deeper than the Eddy soils and not so gravelly. They are shallower than the Austin soils.

Stephen silty clay, 1 to 3 percent slopes (StB).—This gently sloping soil ranges from 8 to 20 inches in thickness and in most places contains more chalk fragments than the Austin soils. About 3 percent of the total acreage mapped is Austin silty clay, 1 to 3 percent slopes, and about 5 percent is Stephen-Eddy complex, 1 to 3 percent slopes, eroded. This soil is suited to cultivated crops but is shallow and droughty. It produces good yields of small grains and other cool-season crops. (Capability unit IIIe-2; Chalky Ridge range site)

Stephen-Eddy complex, 1 to 3 percent slopes, eroded (SeB2).—Stephen silty clay, eroded, makes up about 50 to 80 percent of the complex. It ranges from 8 to 20 inches in thickness and has an average depth to chalky bedrock of about 15 inches. Eddy gravelly clay loam makes up about 20 to 50 percent of the complex. It occurs with the Stephen soil in such an intricate pattern that mapping it separately at the scale used is not practical. Small washes are fairly common in these soils, and a few small gullies have cut into the chalky bedrock. About 3 percent of the total acreage mapped is Stephen silty clay, 1 to 3 percent slopes. In most places the complex consists of broad bands of Stephen soils that alternate with narrow bands of Eddy soils and that approximately follow the contour. Generally, these bands are not more than a few hundred feet wide.

Mainly because they are shallow, the soils of this complex are droughty. They are best suited to small grains, sweetclover, and other cool-season crops that will protect them from heavy rains in spring. (Capability unit IIIe-2; Chalky Ridge range site)

Stephen-Eddy complex, 3 to 5 percent slopes, eroded (SeC2).—Stephen silty clay, 3 to 5 percent slopes, eroded, makes up 52 to 70 percent of the complex. This soil ranges from 8 to 20 inches in thickness and has an average thickness of 12 to 15 inches. It is underlain by chalky bedrock. The surface layer is usually lighter colored than that of less sloping Stephen soils. Eddy gravelly clay loam, 3 to 6 percent slopes, eroded, makes up 22 to 40 percent. The soil pattern of the complex is similar to that in Stephen-Eddy complex, 1 to 3 percent slopes, eroded. Small gullies are fairly common, and a few that are uncrossable have cut into the chalky bedrock. In most places this soil receives runoff from higher lying soils. Mapped areas of this complex contain about 8 percent of Eddy soils, 3 to 8 percent slopes, eroded.

These soils are droughty and suitable for only infrequent cultivation of row crops. They should be kept in continuous cover most of the time to protect them from erosion. Small grains, sweetclover, and other cool-season crops are good on these soils because they are close growing and protect the soils in spring when rains generally are heaviest. (Capability unit IVe-1; Chalky Ridge range site)

Stidham Series

Soils of the Stidham series are grayish-brown loamy fine sands on low benches adjacent to the flood plain of the Trinity River. Slopes range from about 0 to 3 percent.

The surface layer is about 20 inches thick. In most places it is grayish brown in the upper few inches but is lighter colored in the lower part. It has weak, subangular blocky to single-grain structure and is loose when dry and friable when moist. This slightly acid soil takes in water rapidly.

The sandy clay loam subsoil is about 30 inches thick. It is brownish yellow, mottled with red in the lower part. It has weak, subangular blocky structure and is friable when moist and slightly sticky when wet. This layer is moderately permeable.

The parent material is neutral to alkaline sandy alluvium.

In wooded areas the surface layer of Stidham soils is very dark grayish brown in the upper few inches. Thickness ranges from about 18 to 32 inches.

Stidham soils differ from Pratt soils in having a finer textured subsoil. They are similar to Dougherty soils but do not have a reddish, unmottled subsoil.

In Ellis County, Stidham soils are mapped only in Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes, which is a complex described under the Dougherty series.

Sumter Series

In the Sumter series are moderately deep, sloping to strongly sloping clays that are severely eroded and in most places are cut by many uncrossable gullies.

The pale-olive surface layer is about 6 inches thick. It has blocky structure and is hard when dry but firm when moist. This layer crusts in severely eroded areas.

The subsoil is mottled, olive and brownish-yellow heavy clay, about 30 inches thick. It contains many concretions of calcium carbonate and grades to marl or to shale.

The parent material is weathered clayey marl rich in lime in most parts of the county but is shale in the western part. In places it contains thin, hard, brown fragments of limestone. Most areas of Sumter soils formed in the subsoil of Houston soils after the surface layer eroded away. Sumter soils in the western part of the county occur over dense shale.

Sumter soils are thinner and more sloping than Houston soils. They are more friable and not so dense as Ellis soils. They are more clayey and thinner than the Lewisville soils, which developed in sloping old alluvium.

Sumter clay, 5 to 12 percent slopes, severely eroded (SuE3).—Erosion has removed the surface layer from most areas of this strongly sloping to moderately steep soil and has formed many uncrossable gullies. This soil is about 40 inches thick and is underlain by clayey marl or clayey shale. Mapped areas of this soil include as much as 3 percent Ellis and Houston clays, 5 to 12 percent slopes, severely eroded, and as much as 5 percent Houston-Sumter complex, 5 to 8 percent slopes, severely eroded.

This soil is not suited to cultivated crops. It is suited to pasture, but grazing must be controlled. This soil is best suited to native grasses and other permanent plants. (Capability unit VIe–2; Gullied Blackland range site)

Trinity Series

In the Trinity series are deep heavy clays on the flood plain of streams. These soils are nearly level and have slow surface drainage. They contain ample lime for most crops and are productive.

The dark-gray surface layer is about 30 inches thick. It has moderate, fine, blocky to granular structure and is hard when dry but plastic when wet. This layer is self-mulching and cracks when it dries. Most cultivated soils contain a plowpan, which is a layer just below plow depth that has been compacted.

The subsoil is very dark gray heavy clay, about 50 inches thick, that grades to old alluvium. It has blocky structure and takes in water slowly. This layer cracks when it dries, and the cracks increase the intake of water.

The parent material is calcareous alluvium that washed mainly from the blackland prairie. Beds of stratified sand and gravel are beneath the parent material in many places.

On the flood plain of streams that drain from the Austin soils, the Trinity soils are browner than normal. They are somewhat olive where the streams drain from Houston and Ellis soils. In large areas on the Trinity River flood plain, they are darker than normal. In places Trinity soils grade to sandy loam at about 30 inches.

Trinity soils have a surface layer similar to that in Houston Black clay, which occurs at higher elevations. They are much finer textured than the Frio soils.

Trinity clay, frequently flooded (Tc).—This soil occurs on the lower part of the flood plain. It is slightly undulating in places. Mapped areas of this soil include small areas of Frio silty clay, frequently flooded, and of Trinity clay, occasionally flooded.

Because it is flooded frequently, this soil is not suited to cultivated crops. It should be kept in permanent grasses. Ponding (fig. 24) may occur after heavy rains. (Capability unit Vw–1; Bottomland range site)

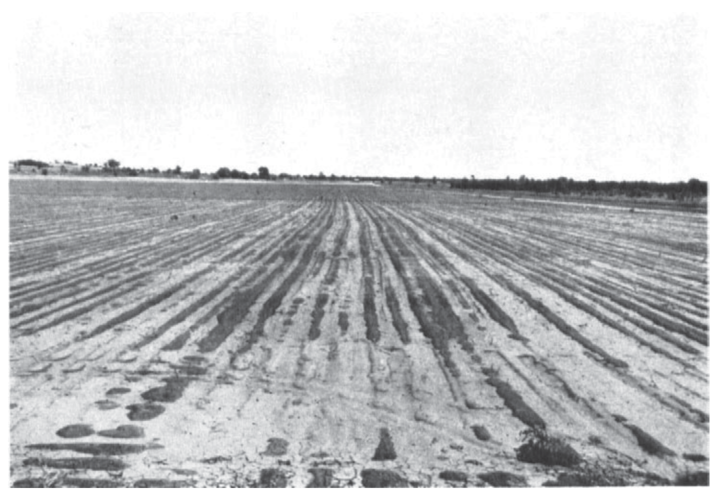

Figure 24.—**Because of slow surface runoff, water is ponded on Trinity clay soil.**

Trinity clay, loamy substratum (Ts).—This soil is about 30 inches thick and grades to loamy material. Mapped areas of this soil include small areas of Trinity clay, occasionally flooded.

This soil is well suited to cultivated crops and produces excellent yields of all field crops grown in the county. It has good drainage and is somewhat subirrigated. (Capability unit I–1; Bottomland range site)

Trinity clay, occasionally flooded (To).—This nearly level soil is adequately drained for cultivated crops. It is about 80 inches thick and is underlain by old alluvium that is less clayey than the surface layer. Mapped areas of this soil include small areas of Frio silty clay, occasionally flooded, and of Trinity clay, frequently flooded.

This soil is suited to cultivated crops and is flooded only occasionally. It is adequately drained and produces good yields. (Capability unit IIs–1; Bottomland range site)

Trinity clay, wet (Tr).—This soil is in flat to slightly depressional areas that have very slow surface drainage. It is about 80 inches thick and is underlain by old alluvium that is less clayey than the surface layer. Ponding is a problem. Mapped areas of this soil include small areas of Trinity clay, occasionally flooded, and of Trinity clay, frequently flooded.

During rains of only average intensity, runoff from adjacent areas is likely to cause ponding (fig. 25).

Because it is wet and drainage is usually difficult, this soil is poorly suited to cultivated crops. It stays wet and cold until late in spring. It is best suited to crops that grow in summer. (Capability unit IIIw-1; Bottomland range site)

Figure 25.—**Water ponded on Trinity clay, wet.**

Wilson Series

In the Wilson series are nearly level to gently sloping clay loams and fine sandy loams that have a claypan. These soils crust readily after rains and become hard when they dry. Their subsoil takes in water very slowly.

The dark-gray surface layer is about 5 to 15 inches thick and is underlain by dense clay. This layer has fine, granular structure and is hard when dry but friable when moist.

The subsoil is dense, dark-gray clay that has weak, blocky to massive structure. It is about 30 inches thick over clayey marl or old alluvium. It takes in water slowly.

The parent material is mainly weathered clayey marl that contains many concretions of iron and calcium carbonate or is old alluvium apparently high in sodium.

The Wilson soils are thickest on the large, nearly level ridgetops and stream terraces and are thinnest on gentle slopes near Houston soils. Most of the Wilson soils are in the eastern part of the county and are underlain by the Taylor formation. They also occur on terraces along the Trinity River, Cummins and Waxahachie Creeks, and other major streams. On terraces Wilson soils are in the lower areas.

In most places the parent material grades to water-bearing layers of stratified sand and gravel. These areas are a source of gravel used locally in structures.

Wilson terrace soils are slightly undulating in places. The large areas of these soils are deepest and most uniform in texture.

Native mesquite (fig. 26) is a persistent problem in heavily grazed native pasture and in old abandoned pasture on Wilson soils.

Figure 26.—**Mesquite invading native pasture on Wilson soil.**

Wilson clay loam, 0 to 1 percent slopes (WsA).—This soil generally is in large, nearly level areas. It is about 80 inches thick and grades to clayey marl. Mapped areas of this soil include small areas of Houston Black clay, 0 to 1 percent slopes, and of Wilson fine sandy loam, 0 to 1 percent slopes.

This soil is suited to cultivated crops and produces fair yields. It is not suited to crops that require large amounts of lime. Crops that produce much residue are needed, and the residue should be managed to prevent a surface crust and a plowpan from forming. (Capability unit IIs-2; Grayland range site)

Wilson clay loam, 1 to 3 percent slopes (WsB).—This gently sloping soil is about 70 inches thick and is underlain by clayey marl. Mapped areas of this soil include small areas of Houston Black clay, 1 to 3 percent slopes; of Wilson fine sandy loam, 1 to 3 percent slopes; and of Wilson clay loam, 1 to 3 percent slopes, eroded.

This soil is suited to cultivated crops and produces fair yields. It is not suited to crops that require much lime. Good management of crop residue is needed to control erosion and to prevent a surface crust and a plowpan from forming. The loamy surface layer warms up quickly in spring, and early growth is rapid. (Capability unit IIIe-1; Grayland range site)

Wilson clay loam, 1 to 3 percent slopes, eroded (WsB2).—Erosion has removed the darker part of the surface layer from about 50 percent of this gently sloping soil and has formed small, shallow gullies. This soil is about 50 inches thick and is underlain by clayey marl. Areas mapped as this soil include small areas of Houston Black clay, 1 to 3 percent slopes; of Houston clay, 1 to 3 percent slopes; of Crockett soils, 2 to 5 percent slopes, eroded; and of Wilson fine sandy loam, 1 to 3 percent slopes.

This soil is poorly suited to cultivated crops, and good management is needed to control erosion and to produce fair yields. It is not suited to crops that require much lime. Slickspots are common on this soil. Because further erosion is likely, clean-tilled crops should be used sparingly. (Capability unit IVe-2; Grayland range site)

Wilson clay loam, terrace, 0 to 1 percent slopes (WtA).—This nearly level soil is about 54 inches thick and is underlain by old alluvium. The dark-gray surface layer is about 6 inches thick. The subsoil is about 25 inches thick and grades through a thick transition layer to old alluvium. Surface drainage is slow but is adequate for cultivated crops.

Mapped areas of this soil include small areas of Burleson clay, terrace, 0 to 1 percent slopes; of Houston Black clay, terrace, 0 to 1 percent slopes; and of Wilson clay loam, terrace, 1 to 3 percent slopes.

This soil is suited to cultivated crops and produces good yields. Good management is needed to prevent a surface crust and a plowpan from forming. Flat areas remain wet and cold in spring. The soil is not suited to crops that require much lime. (Capability unit IIs-2; Grayland range site)

Wilson clay loam, terrace, 1 to 3 percent slopes (WtB).—This well-drained, gently sloping soil is about 46 inches thick and is underlain by old alluvium. A few small washes occur in places. Mapped areas of this soil include small areas of Burleson clay, terrace, 1 to 3 percent slopes; of Houston Black clay, terrace, 1 to 3 percent slopes; and of Wilson fine sandy loam, 1 to 3 percent slopes.

This soil is suited to cultivated crops and produces good yields. It is somewhat droughty late in summer. It needs practices that control erosion and good management of crop residue that prevents crusting. Crops that require large amounts of lime are not adapted to this soil. (Capability unit IIIe-1; Grayland range site)

Wilson fine sandy loam, 0 to 1 percent slopes (WfA).—This nearly level soil is about 70 inches thick and is underlain by clayey marl. Mapped areas of this soil include small areas of Wilson clay loam, 0 to 1 percent slopes.

This soil is suited to cultivated crops and produces fair yields. Good management of crop residue is needed to prevent a crust from forming. Crops that require much lime are not suited. Because this soil warms up quickly in spring, plants make rapid early growth. (Capability unit IIs-2; Grayland range site)

Wilson fine sandy loam, 1 to 3 percent slopes (WfB).—This gently sloping soil is about 60 inches thick and is underlain by clayey marl. Areas mapped as this soil include small areas of Wilson clay loam, 1 to 3 percent slopes, and of Crockett soils, 2 to 5 percent slopes, eroded.

This soil is suited to cultivated crops that do not require large amounts of lime. Good management of crop residue is needed to control erosion and to prevent a crust from forming. The fine sandy loam surface layer (fig. 27) warms up early in spring but is too droughty to maintain adequate plant growth late in summer. (Capability unit IIIe-1; Grayland range site)

***Figure 27.*—Profile of Wilson fine sandy loam. The dark-gray surface layer is fine sandy loam; the lighter colored lower layer is clayey marl.**

Use and Management of Soils

This section discusses the use and management of soils in Ellis County for crops, range, and wildlife, and also for use in roads, agricultural structures, and other engineering work.

Managing Soils for Crops

This subsection consists of five main parts. The first discusses some practices of good soil management. The second lists in a table the estimated yields for cotton, corn, and grain sorghum that can be expected under two levels of management on each soil, and suitability ratings for burmudagrass and King Ranch bluestem. The third part explains the system used by the Soil Conservation Service to classify soils according to capability. The fourth lists the soils in each capability unit and discusses their use and management. The fifth part discusses the use and management of soils for hay and tame pasture.

General practices of soil management

The following practices of good soil management are needed in Ellis County:

1. A sequence of crops that controls surface washing, prevents crusting, keeps the soil in good tilth, and provides enough residue to maintain a high organic-matter content.
2. A suitable system of terraces and waterways to control runoff and erosion and to provide guidelines for contour tillage.
3. Contour farming in which all tilling is on the contour so that terraces are protected, water intake is increased, and erosion control is improved.
4. Minimum tillage so that compacting the soil is avoided and puddling is prevented by tilling only within a suitable range of moisture content.

5. The use of fertilizers and lime according to the results of soil tests or field trials.
6. Good management of crop residue.

Sequence of crops.—Cultivation reduces the supply of organic matter, removes plant nutrients, and increases the hazard of erosion. But a soil is protected and its productivity maintained by a sequence of crops that provides perennial sod or annual cover crops between periods of cultivation, or by crops that produce large amounts of residue. Cotton or another crop that requires several operations in its cultivation can be followed by a crop that produces large amounts of residue, which helps to recondition the soil. Small grains, grain sorghum (see fig. 21, p. 19), and other crops produce large amounts of residue that helps to maintain the supply of organic matter. The residue also improves tilth and helps to control erosion. Experiments at Renner (*5*) have shown that about 3,600 pounds of residue per acre are needed annually on the heavy blackland soils to keep them from deteriorating. In order to produce consistently this amount of residue, well-fertilized, high residue-producing crops must be grown most of the time.

The use of perennial grasses and legumes for hay or pasture allows a more diversified cropping system and accomplishes the same results as growing small grains, grain sorghum, and similar crops. In addition it spreads the farm income through the sale of hay or livestock. Suitable plants for hay or pasture are johnsongrass, fescue, King Ranch bluestem, Indiangrass, switchgrass, biennial sweetclover, and alfalfa. Sometimes used with these perennial grasses are Hubam sweetclover, buttonclover, hairy vetch, and other annual legumes.

Most of the soils of Ellis County are fine textured. These soils crust when they dry; when they are wet, water runs off rapidly and they erode. A cropping system is needed that provides close-growing and high residue-producing crops, which prevent a crust from forming and help to control erosion.

Terraces and waterways.—A terrace is a ridge, or a combination of a ridge and a channel, built at right angles to the slope to divert or to reduce the flow of water. Terraces are used to reduce erosion and to conserve water.

Before a terrace is built, a grassed waterway must be provided to receive the water discharged from the terrace channel. A grassed waterway generally is a natural draw that has been reshaped or graded and then sodded or seeded to a suitable grass. After the grass is established, the terrace can be built. However, grassed waterways are needed in the natural draws of cultivated fields, even if the fields are not terraced.

Because terraces are built on or near the contour, they serve as guidelines for contour farming.

Contour farming.—Contour farming consists of plowing, planting, and cultivating across the slope. In plowing a terraced field, the top of the terrace ridge is the guideline for the first furrow. It is also the guideline for the first row when the field is planted to row crops. If the field is not terraced, a contour line can be laid out with an engineer's or other convenient level. In a field that is planted on the contour, the furrows caused by cultivation hold rainwater or conduct it slowly to a prepared waterway. Thus, water is conserved and erosion is reduced.

Minimum tillage.—Minimum tillage is the least amount of tillage needed for quick germination of seed, for providing a good stand of plants, for controlling undesirable plants, and for obtaining profitable yields. It is used in varying degrees by farmers in the county. Most of them shred the residue of the previous crop, root out the stubs with a sweep, and mix some of the stubs and other residue with the surface soil to form a bed. Much of the residue is left on the surface. Generally, no other tillage is needed until time to plant the next crop. By reducing the number of trips over the field the cost of producing a crop is reduced. Also, compaction of the soil is decreased, the chance of tilling when wet is lessened, and tilth is maintained.

Fertilizers and lime.—Most of the soils in Ellis County are deficient in plant nutrients, particularly nitrogen and phosphorus. To obtain satisfactory crop yields, these nutrients must be supplied by applying commercial fertilizer. The kind of soil and the treatment it has received in former years generally affect the kind and amount of fertilizer needed to produce good yields. However, the kind and amount needed for a specified crop should be determined by a soil test. Information on sampling and testing can be obtained from the county agricultural agent or from the technicians of the Soil Conservation Service.

Calcareous soils in the county are deficient in phosphorus, but they generally contain enough potassium to meet the needs of most plants. Nitrogen varies according to past cropping and soil management. The soils of this kind are the Austin, Eddy, Ellis and Houston, Frio, Houston, Houston Black, Hunt, Lamar, Lewisville, Sumter, and Trinity. Legumes on these soils need moderate applications of phosphate. Legumes seeded in eroded areas also need nitrogen to help establish the crop. Crops other than legumes need nitrogen and phosphate. Well-fertilized small grains and legumes in the cropping system help maintain fertility. Soils receiving large amounts of residue from grain sorghum or a similar crop need large additions of nitrogen when the next crop is planted. At least 20 pounds of nitrogen should be applied for each ton of residue left on the land.

The soils in Ellis county that are low in lime are the Bates, Burleson, Crockett, Dougherty, Stidham, Payne, Hunt, and Wilson. Most of these soils are deficient in lime only in the surface layer. They have ample lime in the lower subsoil. This deficiency prevents the use of sweetclover, alfalfa, and other legumes in the cropping system. These acid soils are generally low in phosphorus, but they contain a moderate amount of potassium. Nitrogen varies within the individual fields according to past cropping and soil management. A few of the sandier soils of this group are fairly deficient in all of the major plant nutrients and require a complete fertilizer for all crops.

Most soils that are low in lime respond well to fertilizer. Well-fertilized small grains and legumes in the cropping system help to maintain fertility. Fields that receive large amounts of residue require about 20 pounds of nitrogen per ton of residue before the next crop is planted. In this group, the Burleson and Hunt soils are heavy clays and do not respond so well to fertilizer as do the loamy soils.

In recent years tissue tests on plants have shown a deficiency in potassium during the fruiting stage of plants. Consequently, a light application of potassium benefits most crops.

Plants growing on the moderately alkaline blackland may show various degrees of iron chlorosis (*9*). The symptoms of this disease are yellowing of the foliage, lack of vigor, unproductiveness, and diebacks. Affected first in spring are plants on the Austin, Brackett, Eddy, Lewisville, and other of the more permeable and more droughty soils. The disease is more severe on these soils than it is on deeper, more clayey soils.

Iron chlorosis is evident on trees and shrubs around the homesite on farms, in orchards, along fence rows, and in towns. Some plants that are affected first in spring are peach, pear, plum, mimosa (silk tree—*Albizia julibrissin*) (*10*), the various privets used for hedges, and cowpeas. Pines planted in landscaping remain small, are yellowish in color, and are short lived. They begin to show signs of iron chlorosis late in spring or early in summer. The disease becomes very pronounced if the soil moisture is low at about that time of the year. Generally the disease is less pronounced in the general field crops than it is in the trees mentioned.

Probably because the main cash crops are not affected by iron chlorosis, amendments to make iron more available to plants have been little used in the blackland. Spraying plants needing iron with a solution containing soluble iron would be helpful.

Management of crop residue.—Good management of crop residue is essential for maximum erosion control. If the residue consists of coarse stalks of plants, it should be shredded so that the stalks do not interfere with plowing for the next crop. All available residue should be left on the surface or in the surface soil if erosion or surface crusting are main problems.

Crop residue left on the land protects the soil from falling raindrops. These raindrops churn up the soil and make it susceptible to washing. Also, the residue assists in conserving soil moisture by insulating the surface. It increases infiltration of water into the soil where the water can be stored. When residue decomposes into humus, it loosens the soil and improves tilth. Residue is a food for micro-organisms, the activities of which are essential in releasing plant food for growing crops.

Estimated yields

In table 2, for each soil in the county, are estimated average acre yields of cotton, corn, and grain sorghum, as well as suitability ratings of the soils for pasture of bermudagrass and of King Ranch bluestem. The estimated yields are given for two levels of management.

In columns A of table 2 are yields to be expected under management generally practiced in the county. In this management—

1. Clean-tilled row crops are planted year after year.
2. Legumes and small grains are not regularly used in the cropping system.
3. Erosion is not controlled.
4. The soil is plowed when it is wet, one or more times each year.
5. Crop residue is not managed well.
6. Commercial fertilizers are seldom used.

In columns B are yields to be expected under improved management. In this management—

1. Clean-tilled row crops are alternated with close-growing crops.
2. Legumes and small grains that are fertilized are grown in the cropping system.
3. Erosion is controlled fairly well.
4. Soils are tilled only when they are within a safe range of moisture content.
5. Crop residue is shredded and left on the surface or in the surface soil.
6. Commercial fertilizers are used in the cropping system, mainly on legumes.

TABLE 2.—*Estimated average acre yields of principal crops and suitability of tame grasses*

[Yields in columns A are those obtained under management generally practiced; those in columns B are obtained under improved management. Absence of yield indicates that the crop is not generally grown on the soil or that the soil is not suited to the crop]

Soil	Estimated yields of—						Suitability for—	
	Cotton (lint)		Corn		Grain sorghum		Bermudagrass	King Ranch bluestem
	A	B	A	B	A	B		
	Lb.	*Lb.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*		
Austin silty clay, 1 to 3 percent slopes	125	200	22	40	1,500	2,700	Good	Excellent.
Austin silty clay, 3 to 5 percent slopes, eroded	50	100	15	25	900	1,800	Good	Excellent.
Austin silty clay, 5 to 8 percent slopes, eroded							Fair	Good.
Bates fine sandy loam, 3 to 5 percent slopes, eroded							Good	Good.
Bates-Lamar complex, 5 to 12 percent slopes, eroded							Fair	Fair.
Brackett and Austin soils, 2 to 5 percent slopes, eroded							Fair	Good.
Broken alluvial land							Fair	Good.
Burleson clay, 0 to 1 percent slopes	100	200	18	25	1,500	2,200	Good	Good.
Burleson clay, 1 to 3 percent slopes	85	175	15	25	1,200	1,800	Good	Good.

TABLE 2.—*Estimated average acre yields of principal crops and suitability of tame grasses*—Continued

Soil	Estimated yields of—						Suitability for—	
	Cotton (lint)		Corn		Grain sorghum		Bermuda-grass	King Ranch bluestem
	A	B	A	B	A	B		
	Lb.	*Lb.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*		
Burleson clay, depressional							Good	Good.
Burleson clay, terrace, 0 to 1 percent slopes	125	250	20	32	1, 800	2, 800	Good	Good.
Burleson clay, terrace, 1 to 3 percent slopes	125	250	20	32	1, 800	2, 800	Good	Good.
Crockett soils, 2 to 5 percent slopes, eroded							Fair	Good.
Crockett soils, 3 to 8 percent slopes, severely eroded							Fair	Fair.
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes	125	200	22	35	1, 500	2, 700	Excellent	Excellent.
Eddy gravelly clay loam, 1 to 3 percent slopes							Fair	Good.
Eddy soils, 3 to 8 percent slopes, eroded								Fair.
Eddy soils, 8 to 20 percent slopes								Fair.
Ellis and Houston clays, 3 to 5 percent slopes, eroded	50	125	8	15	500	1, 000	Fair	Good.
Ellis and Houston clays, 5 to 12 percent slopes, severely eroded.								Fair.
Frio loam (0 to 1 percent slopes)	200	400	35	50	2, 000	3, 500	Excellent	Excellent.
Frio silty clay, frequently flooded							Excellent	
Frio silty clay, occasionally flooded	185	325	30	45	2, 000	4, 000	Excellent	Excellent.
Gullied land							Fair	Fair.
Houston-Sumter complex, 5 to 8 percent slopes, severely eroded.							Fair	Fair.
Houston clay, 1 to 3 percent slopes	125	200	22	35	1, 500	2, 700	Good	Excellent.
Houston clay, 3 to 5 percent slopes, eroded	75	125	15	25	1, 000	1, 800	Fair	Good.
Houston clay, 5 to 8 percent slopes, eroded							Fair	Good.
Houston and Ellis clays, 1 to 3 percent slopes	80	150	12	20	700	1, 500	Fair	Good.
Houston Black clay, 0 to 1 percent slopes	175	275	27	45	1, 800	3, 200	Good	Excellent.
Houston Black clay, 1 to 3 percent slopes	175	275	27	45	1, 800	3, 200	Good	Excellent.
Houston Black clay, terrace, 0 to 1 percent slopes	175	300	27	45	2, 000	3, 500	Good	Excellent.
Houston Black clay, terrace, 1 to 3 percent slopes	150	300	27	45	2, 000	3, 500	Good	Excellent.
Hunt clay, 0 to 1 percent slopes	175	275	27	42	1, 800	3, 200	Good	Excellent.
Hunt clay, 1 to 3 percent slopes	150	250	28	40	1, 800	2, 800	Good	Excellent.
Lamar clay loam, 2 to 5 percent slopes, eroded							Excellent	Excellent.
Lamar clay loam, 5 to 12 percent slopes, eroded							Good	Good.
Lewisville association, 1 to 3 percent slopes	150	300	25	40	1, 800	3, 200	Excellent	Excellent.
Lewisville association, 3 to 5 percent slopes, eroded	100	150	15	25	1, 200	2, 000	Good	Excellent.
Lewisville association, 5 to 8 percent slopes, eroded							Good	Good.
Lewisville silty clay, 0 to 1 percent slopes	200	400	35	50	2, 500	4, 500	Excellent	Excellent.
Lewisville silty clay, 1 to 3 percent slopes	150	300	25	40	1, 800	3, 200	Excellent	Excellent.
Lewisville silty clay, 3 to 5 percent slopes, eroded	100	150	15	25	1, 200	2, 000	Good	Excellent.
Lewisville silty clay, 5 to 8 percent slopes, eroded							Fair	Good.
Lewisville soils, 5 to 8 percent slopes, severely eroded							Fair	Good.
Payne clay loam, 0 to 2 percent slopes	140	230	22	35	2, 000	3, 000	Good	Excellent.
Payne and Norge soils, 1 to 3 percent slopes	130	200	22	32	1, 500	2, 200	Good	Excellent.
Pratt loamy fine sand, terrace, 0 to 3 percent slopes							Excellent	Good.
Stephen silty clay, 1 to 3 percent slopes	75	150	10	20	700	2, 000	Fair	Good.
Stephen-Eddy complex, 1 to 3 percent slopes, eroded	60	85	10	16	500	1, 600	Fair	Good.
Stephen-Eddy complex, 3 to 5 percent slopes, eroded							Fair	Good.
Sumter clay, 5 to 12 percent slopes, severely eroded							Fair	Fair.
Trinity clay, frequently flooded							Good	
Trinity clay, loamy substratum	185	325	30	50	2, 500	4, 000	Excellent	Excellent.
Trinity clay, occasionally flooded	175	300	30	45	2, 000	3, 500	Excellent	Excellent.
Trinity clay, wet							Fair	
Wilson clay loam, 0 to 1 percent slopes	100	225	20	30	1, 800	2, 800	Good	Good.
Wilson clay loam, 1 to 3 percent slopes	100	200	15	25	1, 000	1, 800	Good	Good.
Wilson clay loam, 1 to 3 percent slopes, eroded	80	150	12	20	800	1, 200	Fair	Good.
Wilson clay loam, terrace, 0 to 1 percent slopes	100	225	20	30	1, 800	2, 800	Excellent	Good.
Wilson clay loam, terrace, 1 to 3 percent slopes	100	200	15	25	1, 000	1, 800	Excellent	Good.
Wilson fine sandy loam, 0 to 1 percent slopes	100	200	20	30	1, 200	2, 000	Good	Good.
Wilson fine sandy loam, 1 to 3 percent slopes	80	180	15	25	1, 000	1, 800	Good	Good.

Capability groups of soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. Eight capability classes are in the broadest grouping and are designated by Roman numerals I through VIII; however, no soils in Ellis County are in class VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclass is indicated 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 a close-growing plant cover is maintained; *w* means that water in or on the soil will interfere 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 country, indicates 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 or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are susceptible to little or no erosion but have other limitations that confine their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units. These units are groups of soils that 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 are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units according to the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.
- Capability unit I-1.—Deep, nearly level, friable soils that have a moderately permeable subsoil.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe-1.—Deep, gently sloping, friable clays, silty clays, and loamy soils.
  - Capability unit IIe-2.—Deep, gently sloping clays.
  - Capability unit IIe-3.—Deep, nearly level to gently sloping loamy fine sands that have a moderately permeable subsoil.
- Subclass IIs. Soils that have moderate root zone limitations.
  - Capability unit IIs-1.—Deep, nearly level, calcareous clays.
  - Capability unit IIs-2.—Deep, nearly level, clayey soils that crust.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to erosion if they are cultivated and not protected.
  - Capability unit IIIe-1.—Deep, gently sloping clays, clay loams, and fine sandy loams that crust.
  - Capability unit IIIe-2.—Moderately deep, friable soils that are gently sloping to moderately sloping and eroded.
  - Capability unit IIIe-3.—Moderately deep, gently sloping to moderately sloping heavy clays.
  - Capability unit IIIe-4.—Deep, moderately sloping fine sandy loam.
- Subclass IIIw. Soils with severe limitations because of excess water.
  - Capability unit IIIw-1.—Deep heavy clays in slight depressions.
- Subclass IIIs. Soils that have severe limitations of root zone.
  - Capability unit IIIs-1.—Deep, gently sloping loamy fine sand that is on terraces and has a moderately to rapidly permeable subsoil.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
  - Capability unit IVe-1.—Shallow to moderately deep, friable soils that are gently sloping to moderately sloping and eroded.
  - Capability unit IVe-2.—Deep, gently sloping to moderately sloping, eroded, tight soils that crust.
  - Capability unit IVe-3.—Shallow to moderately deep, gently sloping to moderately sloping clays.
- Subclass IVs. Soils with severe limitations of stoniness, low moisture capacity, or other soil features.
  - Capability unit IVs-1.—Very shallow to shallow, friable soils that are gently sloping to moderately sloping.

Class V. Soils not likely to erode but with other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Capability unit Vw-1.—Deep, nearly level, frequently flooded soils on the flood plain of streams.

Class VI. Soils with severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited by risk of erosion if unprotected.

Capability unit VIe-1.—Sloping to strongly sloping shaly clays that are severely eroded and shallow.

Capability unit VIe-2.—Moderately deep, sloping to strongly sloping, calcareous clays.

Capability unit VIe-3.—Very shallow, sloping, gravelly soils.

Capability unit VIe-4.—Moderately deep, sloping to strongly sloping, friable soils.

Capability unit VIe-5.—Deep, sloping to strongly sloping soils that crust and have a clayey subsoil.

Class VII. Soils with very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIIe-1.—Very shallow, strongly sloping to moderately steep gravelly soils.

Capability unit VIIe-2.—Severely gullied lands and areas where gravel has been dug.

Class VIII. Soils and landforms with limitations that preclude their use, without major reclamation, for commercial production of plants; and that restrict their use to recreation, wildlife, water supply, or esthetic purposes. No soils in Ellis County are in Class VIII.

Managing soils in capability units

The soils in one capability unit have about the same limitations and similar risk of damage. The soils in any one unit, therefore, need about the same kind of management. In the following pages, the soils in each capability unit are listed, and some suggestions for their management are made.

CAPABILITY UNIT I-1

In capability unit I-1 are deep, nearly level, friable soils that have a moderately permeable subsoil. These soils take in water readily and store an ample supply for plant use. Erosion is not a serious problem on these soils, and yields are high under good management. The soils are—

Frio loam (0 to 1 percent slopes).
Frio silty clay, occasionally flooded.
Lewisville silty clay, 0 to 1 percent slopes.
Trinity clay, loamy substratum.

These soils have good internal drainage and warm up early in spring. Most crops suited to Ellis County grow well, and cotton, corn, and alfalfa produce especially good yields. Corn can be planted early enough to take advantage of the rains in May. Other crops that grow well are grain sorghum, sweetclover, small grains, sesame, and winter peas.

The main need of these soils is a sequence of crops that maintains good tilth. The layer immediately below the plow layer is compacted by tillage if row crops are grown continuously. Clean-tilled crops should follow small grains, sweetclover, alfalfa, and other close-growing crops. Grain sorghum and other high residue-producing crops help to maintain tilth and to control erosion. The residue from row crops should be shredded and left in the surface layer.

Pasture grasses suitable for these soils are bermudagrass, johnsongrass, fescue, and King Ranch bluestem. Legumes suitable for tame pasture are buttonclover, sweetclover, and alfalfa. Suitable for supplemental pasture are sudangrass, perennial ryegrass, rescuegrass, and small grains. Large additions of nitrogen and phosphate fertilizers are needed on pasture.

CAPABILITY UNIT IIe-1

In capability unit IIe-1 are friable clays, silty clays, and loamy soils that are deep and gently sloping. These soils have a moderately permeable subsoil, and they take in water readily and store an ample supply for plant use. Because of their slope, these soils are moderately susceptible to erosion. They are—

Austin silty clay, 1 to 3 percent slopes.
Lewisville association, 1 to 3 percent slopes.
Lewisville silty clay, 1 to 3 percent slopes.

These soils have good internal drainage, but they are somewhat droughty late in summer. Early corn does well because it grows rapidly early in the growing season. Small grains, sweetclover, and other cool-season crops are especially well suited to these soils.

The main needs of these soils are practices that control erosion. Terraces and contour tillage are essential if the soils are used mostly for row crops. High residue-producing crops and deep-rooted plants are generally desirable in the cropping system because they help to reduce erosion and excessive compaction. These crops also provide litter that protects the surface and prevents a plowpan from forming. All residue from the row crops should be shredded and left in the surface layer.

Pasture grasses suitable for these soils are King Ranch bluestem, johnsongrass, fescue, and bermudagrass. Legumes suitable for pasture are buttonclover and sweetclover. Suitable for supplemental pasture are sudangrass, perennial ryegrass, small grains, and sorghum almum. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IIe-2

The soils in capability unit IIe-2 are deep, gently sloping clays. These soils have a slowly permeable subsoil, which hinders the movement of water and air and the growth of plant roots. Water, however, enters the soil readily through surface cracks caused by drying. Because of their slopes, these soils are moderately susceptible to erosion. Small rills and gullies occur in places. The soils are difficult to maintain in good tilth because of the narrow range of moisture content within which they can be cultivated. The soils are—

Houston Black clay, 1 to 3 percent slopes.
Houston Black clay, terrace, 1 to 3 percent slopes.
Houston clay, 1 to 3 percent slopes.
Hunt clay, 1 to 3 percent slopes.

These soils produce good yields of row crops and close-growing crops. Suitable row crops are cotton, corn, grain sorghum, and soybeans. Small grains, sweetclover, and alfalfa are suitable close-growing crops.

These soils mainly need practices that control erosion and provide the additional organic matter required to maintain good tilth. If these soils are planted to row crops, terraces and contour tillage are needed. Although a plowpan forms readily in these clay soils, it can be prevented by using appropriate tillage and by including perennial crops in the cropping system. Avoid excess tilling and tilling when the soil is wet. All crop residue should be shredded and left in the surface layer. Including close-growing crops in the cropping system at least 1 year in every 3 keeps the soil in good tilth and helps to control erosion.

Pasture grasses suitable for these soils are bermudagrass, fescue, johnsongrass, and King Ranch bluestem. Legumes suitable for tame pasture are sweetclover, alfalfa, buttonclover, and vetch. Suitable for supplemental pasture are sudangrass, rescuegrass, small grains, and sorghum almum. Large amounts of nitrogen and phosphate fertilizers are needed on all kinds of pasture.

CAPABILITY UNIT IIe-3

Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes, are the only soils in capability unit IIe-3. These soils are deep, nearly level to gently sloping loamy fine sands that have a moderately permeable subsoil. They store ample moisture for plants, and they are moderately susceptible to erosion.

These soils have good surface drainage, and their loamy surface layer warms up early in spring. Yields of small grains, vetch, peas, and other cool-season crops are good. Cotton, corn, and grain sorghum also produce good yields. The content of lime is too low for alfalfa, sweetclover, and similar crops.

The main need of these soils is a sequence of crops that adds organic matter and helps to control erosion. Crop residue returned to the surface layer helps to prevent crusting and to maintain good tilth. If these soils are planted to row crops, terraces and contour tillage are needed. Close-growing crops should be grown at least 1 year in every 3 to help maintain good tilth. Also, all crop residue should be shredded and left in the surface layer.

Pasture grasses suitable for these soils are bermudagrass, King Ranch bluestem, johnsongrass, and fescue. Legumes suitable for pasture are vetch and buttonclover. Suitable for supplemental pasture are sudangrass, rescuegrass, sorghum almum, and small grains. Large amounts of nitrogen and phosphate fertilizers are needed on all kinds of pasture.

CAPABILITY UNIT IIs-1

In capability unit IIs-1 are deep, nearly level, calcareous clays. Runoff is slow. These soils have a slowly permeable subsoil that hinders the movement of water and air and the growth of plant roots. However, they do take in water readily through surface cracks caused by drying. The range of moisture at which they can be cultivated is narrow, and good structure and tilth are difficult to maintain. The soils are—

Houston Black clay, 0 to 1 percent slopes.
Houston Black clay, terrace, 0 to 1 percent slopes.
Hunt clay, 0 to 1 percent slopes.
Trinity clay, occasionally flooded.

Most crops suited to this area can be grown on these soils, but good management is needed for high yields. Because they are fine textured, the soils tend to remain wet and cold in spring. Cotton, grain sorghum, alfalfa, and similar crops grow well. If tilth is good, corn also grows well. Lime is ample for sweetclover, which is well suited.

The main need of these soils is a sequence of crops that maintains good tilth and good internal drainage. If they are tilled, these soils are compacted easily and a plowpan forms. Perennial legumes and grasses are best for preventing a plowpan from forming. If these soils are continuously farmed in row crops, they crust. To prevent crusting, high residue-producing row crops and close-growing crops should be used.

Pasture grasses suitable for these soils are bermudagrass, johnsongrass, fescue, and dallisgrass. Legumes suitable for pasture are buttonclover, sweetclover, vetch, and alfalfa. Suitable for supplemental pasture are sudangrass, perennial ryegrass, sorghum almum, and small grains. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IIs-2

In capability unit IIs-2 are deep, nearly level, clayey soils that crust. Runoff is fairly slow. These soils have a very slowly permeable subsoil that hinders the movement of water, air, and plant roots. They crust readily and harden after rains. They are difficult to keep in good tilth because they can be cultivated within only a narrow range of moisture content. The soils are—

Burleson clay, 0 to 1 percent slopes.
Burleson clay, terrace, 0 to 1 percent slopes.
Wilson clay loam, 0 to 1 percent slopes.
Wilson clay loam, terrace, 0 to 1 percent slopes.
Wilson fine sandy loam, 0 to 1 percent slopes.

Most warm-season crops common in this area grow well on these soils. Internal drainage is slow, and the soils remain wet and cold until late in spring. They produce good yields of cotton and grain sorghum. They are not well suited to corn, because they warm up late in spring and are droughty early in summer before the corn matures. Because these soils are cold and wet during winter, yields of small grains are low. Onions, however, do well. Yields of alfalfa and sweetclover are only fair because the soils are low in lime.

The main need of these soils is a sequence of crops that provides enough residue to maintain good tilth. A plowpan forms readily in clean-tilled areas and hinders the growth of roots. Thus, yields are reduced. Sweetclover, alfalfa, and other legumes that have a high lime requirement are not well suited to these soils. Grain sorghum, sweet sorghum, small grains, and other crops that produce large amounts of residue can be used to maintain good tilth.

Pasture grasses suitable for these soils are bermudagrass, johnsongrass, and King Ranch bluestem. Legumes suitable for pasture are vetch and peas. Suitable for supplemental pasture are sudangrass, sorghum almum, and small grains. Regular applications of nitrogen and phosphate fertilizers improve all kinds of pasture.

CAPABILITY UNIT IIIe-1

In capability unit IIIe-1 are deep, gently sloping clays, clay loams, and fine sandy loams that crust. These soils have a very slowly permeable subsoil that severely hinders the movement of water and air and the growth of plant roots. Soil moisture available for plants is low. Because water moves slowly in these soils, they are droughty. Because of their slope, these soils are moderately susceptible to erosion. The soils are—

Burleson clay, 1 to 3 percent slopes.
Burleson clay, terrace, 1 to 3 percent slopes.
Payne clay loam, 0 to 2 percent slopes.
Payne and Norge soils, 1 to 3 percent slopes.
Wilson clay loam, 1 to 3 percent slopes.
Wilson clay loam, terrace, 1 to 3 percent slopes.
Wilson fine sandy loam, 1 to 3 percent slopes.

These soils are used mainly for general farming, and they produce good yields of cotton, grain sorghum, and small grains. The fine sandy loams and lighter clay loams produce good yields of corn; the heavier clay loams produce good yields of onions. Because the surface layer is low in lime, these soils are not suited to sweetclover and alfalfa. However, they produce good yields of vetch and peas.

The main needs of these soils are practices that control erosion and add organic matter to improve tilth. If these soils are planted to row crops, terraces and contour tillage are needed. Also needed are regular additions of organic matter to prevent a surface crust and a plowpan from forming. Close-growing crops should occupy these soils half of the time. All crop residue should be left in the surface layer. Perennial crops and sod crops are best for preventing a plowpan from forming. The finer textured soils in the capability unit have a fairly narrow range of moisture content at which they can be tilled without damage to tilth. They should not be plowed until they have dried to that range.

Pasture grasses suitable for these soils are bermudagrass, King Ranch bluestem, johnsongrass, and rescuegrass. Legumes suitable for pasture are vetch, peas, and buttonclover. Suitable for supplemental pasture are sudangrass, perennial ryegrass, rescuegrass, sorghum almum, and small grains. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IIIe-2

In capability unit IIIe-2 are moderately deep, friable soils that are gently sloping to moderately sloping and eroded. These soils have a moderately permeable subsoil. They have been damaged considerably by erosion; rills, shallow gullies, and thin spots are common. Most of the organic matter has been removed from the surface layer. Because they are sloping and eroded, these soils take in water slowly and are somewhat droughty. The soils are—

Austin silty clay, 3 to 5 percent slopes, eroded.
Lewisville association, 3 to 5 percent slopes, eroded.
Lewisville silty clay, 3 to 5 percent slopes, eroded.
Stephen silty clay, 1 to 3 percent slopes.
Stephen-Eddy complex, 1 to 3 percent slopes, eroded.

These soils are best suited to cool-season crops that mature early. They are well suited to small grains and annual sweetclover. Cotton root rot is a severe problem on these soils, and in many places it thins the stand enough to make the crop unprofitable.

The main needs of these soils are practices that control erosion and add organic matter. These needs can be met by keeping close-growing crops continuously on this soil or, if terraces are built, by planting close-growing crops 1 year in every 2. Contour tillage should be used if row crops are planted. All crop residue should be left in the surface layer.

Pasture grasses suitable for these soils are King Ranch bluestem, side-oats grama, and bermudagrass. Legumes suitable for pasture are sweetclover, buttonclover, and vetch. Suitable for supplemental pasture are sudangrass, sorghum almum, johnsongrass, and small grains. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IIIe-3

In capability units IIIe-3 are moderately deep, gently sloping to moderately sloping heavy clays. These soils have a slowly permeable to very slowly permeable subsoil that hinders the movement of water, air, and plant roots. Soil moisture available for plant use is low. Because runoff is rapid, these soils are susceptible to moderate erosion. The soils are—

Houston clay, 3 to 5 percent slopes, eroded.
Houston and Ellis clays, 1 to 3 percent slopes.

These soils are best suited to cool-season crops and other crops grown for feed. They are well suited to small grains and sweetclover.

The main needs of these soils are practices that control erosion and add organic matter to maintain good tilth. If the soils are planted to row crops, terraces and contour tillage are needed. These soils are easily compacted and should not be plowed when they are wet. Perennial legumes or sod crops are needed in the cropping system to prevent a plowpan from forming. When planted to row crops, Houston and Ellis clays, 1 to 3 percent slopes, crust readily. On terraces the cropping system should be one that keeps close-growing crops on half of the area. If the area is not terraced, close-growing crops are needed continuously.

Pasture grasses suitable for these soils are King Ranch bluestem, Caucasian bluestem, johnsongrass, and bermudagrass. Legumes suitable for pasture are sweetclover, buttonclover, and vetch. Suitable for supplemental pasture are sudangrass, sorghum almum, and small grains. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IIIe-4

Bates fine sandy loam, 3 to 5 percent slopes, eroded, is the only soil in capability unit IIIe-4. This soil is deep and moderately sloping. Erosion has removed the original surface layer from about 50 percent of the soil, and small gullies have formed. The subsoil is slowly permeable to moderately permeable. Because of the slope, this soil is susceptible to moderate erosion. Good management of crop residue is needed to prevent erosion and to maintain favorable yields.

Adapted crops grow well on this soil. It has good drainage and produces rapid growth early in spring. Because of its location and small area, this soil is used mainly for pasture. A few fields are used for general farming.

The main needs of this soil are practices that control erosion and add organic matter. These needs can be partly met by regularly returning crop residues to the soil. If this soil is planted to row crops, it should be terraced. To control erosion, use close-growing crops only 1 year in every 2 on terraced fields; without terraces, use close-growing crops continuously. It is beneficial for row crops to be followed by cover crops and for all crop residue to be left in the surface layer.

The pasture grass suitable for this soil is mainly bermudagrass. Vetch, peas, crimson clover, and other legumes are suitable for pasture. Suitable for supplemental pasture are sudangrass, johnsongrass, sweet sorghum, sorghum almum, and small grains. All kinds of pasture should receive large amounts of a complete fertilizer. Liming increases the quality of the forage.

CAPABILITY UNIT IIIw-1

In capability unit IIIw-1 are deep heavy clays in slight depressions. These soils are wet in rainy periods because water ponds on them and the permeability of their subsoil is slow to very slow. Because of this wetness, these soils are cold in spring and seeding is delayed. The soils are—

Burleson clay, depressional.
Trinity clay, wet.

These soils are best suited to crops grown late in summer for feed. Because the soils are wet and cold, cool-season crops make poor growth. Suitable crops are sudangrass, grain sorghum, sweet sorghum, and millet. Except during wet years, sweetclover and alfalfa can be grown on the Trinity soil. Summer peas are adapted to the Burleson soil.

The main needs of these soils are surface drainage and a sequence of crops that keeps the soils in good tilth and improves internal drainage. If surface drainage is adequate, these soils can be managed much like the soils in capability unit IIs-1. Without efficient drainage these soils should be planted late so that the crops grow in summer when the soils are drier. Sweetclover and other deep-rooted crops and sod crops improve the internal drainage. These soils puddle readily and should not be tilled or grazed when they are wet.

Pasture grasses suitable for these soils are bermudagrass, fescue, johnsongrass, and dallisgrass. Vetch and peas are legumes suitable on the Burleson soil, and sweetclover and alfalfa are suitable on the Trinity soil. Sudangrass and sorghum almum are good for supplemental pastures. Small grains can be grown in dry years. All kinds of pasture should receive large amounts of nitrogen and phosphate when planted and a regular application of nitrogen during the growing season.

CAPABILITY UNIT IIIs-1

Pratt loamy fine sand, terrace, 0 to 3 percent slopes, is the only soil in capability units IIIs-1. This deep, gently sloping soil has a moderately permeable to rapidly permeable subsoil. Although water is taken into the soil readily, the capacity to store it is low. Natural fertility is also low. The sandy surface layer blows if it is left bare.

Adapted crops grow well on this soil. It is well drained, and crops grow rapidly early in spring. Truck crops are well suited. Vetch and peas are suitable legumes.

The main needs of this soil are crop residue to protect the surface from blowing and fertilizers to supply needed plant nutrients. Crop residue can be added regularly by planting close-growing crops in the cropping system. Clean-tilled crops should be followed by winter cover crops. Leaving all crop residue in the surface layer is beneficial.

Truck crops should receive regular applications of a complete fertilizer. Lime is needed to produce truck crops of good quality.

For pasture, bermudagrass and lovegrass are suitable grasses and vetch and buttonclover are suitable legumes. Suitable for supplemental pasture are sudangrass, sorghum almum, and small grains. All kinds of pasture need regular applications of a complete fertilizer.

CAPABILITY UNIT IVe-1

In capability unit IVe-1 are shallow to moderately deep, friable soils that are gently sloping to moderately sloping and eroded. These soils are moderately permeable to slowly permeable and are somewhat droughty. Small gullies and thin spots are common. The risk of further erosion is moderately severe to severe. The soils are—

Austin silty clay, 5 to 8 percent slopes, eroded.
Lamar clay loam, 2 to 5 percent slopes, eroded.
Lewisville association, 5 to 8 percent slopes, eroded.
Lewisville silty clay, 5 to 8 percent slopes, eroded.
Stephen-Eddy complex, 3 to 5 percent slopes, eroded.

These soils are best suited to crops that do not require much moisture. They produce fair yields of small grains and sweetclover.

The main needs of these soils are practices that control erosion and add organic matter to improve fertility. Because the soils are too steep, terraces generally are not suitable. Row crops should be grown not more than 1 year in 5, and close-growing crops the other years. Fields not terraced should be kept in close-growing crops all the time, and all crop residue left in the surface layer.

Pasture grasses suited to these soils are King Ranch bluestem, Caucasian bluestem, bermudagrass, and other deep-rooted grasses. Buttonclover, sweetclover, vetch, alfalfa, and similar legumes are well suited to pasture. Suitable for supplemental pasture are sorghum almum, sudangrass, and small grains.

All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizer at planting. They should receive a regular application of nitrogen during their growing season.

CAPABILITY UNIT IVe-2

In capability unit IVe–2 are deep, gently sloping to moderately sloping, eroded, tight soils that crust. These soils have a very slowly permeable subsoil that severely hinders the movement of water and air and the growth of plant roots. Much soil material has been lost through erosion; rills, small gullies, and thin spots are common. These soils are somewhat droughty and require good management if good soil structure and tilth are to be maintained. The soils are—

Crockett soils, 2 to 5 percent slopes, eroded.
Wilson clay loam, 1 to 3 percent slopes, eroded.

Crops that do not require large amounts of lime are suited to these soils. Yields of cotton, grain sorghum, and small grains are fair. Vetch and peas are suitable legumes. These soils are too droughty to produce good yields of corn and other row crops.

The main needs of these soils are practices that control erosion and add organic matter to improve tilth. Areas in row crops require terracing and contour tillage. Growing close-growing crops half of the time helps control erosion on terraced fields. On fields not terraced, close-growing crops should be grown continuously. Leaving all crop residue in the surface layer helps to control erosion and to prevent crusting, and using sod crops in the cropping system helps to prevent a plowpan from forming.

Pasture grasses suitable for these soils are King Ranch bluestem, Caucasian bluestem, johnsongrass, and bermudagrass. Legumes suitable for pasture are sweetclover, buttonclover, and vetch. Suitable for supplemental pasture are sourgrass, sudangrass, sorghum almum, and small grains. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers.

CAPABILITY UNIT IVe-3

In capability unit IVe–3 are shallow to moderately deep, gently sloping to moderately sloping clays. Runoff is rapid when these soils are wet, but the soils take in water readily through cracks in their surface when they are dry. These soils have a very slowly permeable subsoil that grades abruptly to clayey marl or shale. The risk of erosion is severe, and small gullies and thin spots are common. These soils crust readily. They are wet and cold in rainy periods and are droughty in dry periods. When they dry after rains, they crack so severely that plant roots are damaged. The soils are—

Ellis and Houston clays, 3 to 5 percent slopes, eroded.
Houston clay, 5 to 8 percent slopes, eroded.

Crops that are somewhat tolerant of drought are suited to these soils, but yields of row crops are low. These soils are best suited to small grains, sweetclover, and other cool-season crops that mature before hot summer weather.

The main needs of these soils are practices that control erosion and add organic matter to improve tilth. To control erosion, terraces and contour tillage are needed, and the terraces should be kept in close-growing crops about half of the time. Close-growing crops grown continuously are required on fields not terraced. All crop residue should be left in the surface layer. A sod crop in the cropping system helps to prevent a surface crust and a plowplan from forming. These soils have a narrow range of moisture content in which they can be tilled without damage to tilth, and they should be plowed only when in that range. All kinds of pasture require large additions of nitrogen and phosphate fertilizers at planting. A regular application of nitrogen during the growing season is beneficial.

CAPABILITY UNIT IVs-1

In capability unit IVs–1 are very shallow to shallow, friable soils that are gently sloping to moderately sloping. These soils are commonly underlain by chalk bedrock or chalky marl at a depth of 6 to 26 inches. They have a thin root zone and are droughty. They produce a fair yield of cool-season plants that mature before the dry, hot summer months. The soils are—

Brackett and Austin soils, 2 to 5 percent slopes, eroded.
Eddy gravelly clay loam, 1 to 3 percent slopes.

The Brackett and Austin soils are thicker than the Eddy soil, and they are somewhat more droughty because of the high content of lime in the surface layer. Crops that tolerate a thin root zone and droughtiness are suitable for the soils in this unit. Yields of small grains and sweetclover are fair, but these soils are too droughty to produce profitable yields of row crops. In thinner areas the chalk bedrock crops out.

The main need of these soils is additional organic matter to help control erosion and to increase fertility. These soils should have continuous cover of close-growing plants. All crop residue should be left in the surface layer.

Pasture grasses suited to these soils are bermudagrass, King Ranch bluestem, Caucasian bluestem, and johnsongrass. Also suitable for pasture are sweetclover and other legumes. Suitable for supplemental pasture are sudangrass, sorghum almum, small grains, and sourgrass. All kinds of pasture should receive large amounts of nitrogen and phosphate fertilizers at planting and a regular application of nitrogen during the growing season.

CAPABILITY UNIT Vw-1

In capability unit Vw–1 are deep, nearly level, frequently flooded soils on the flood plain of streams. These soils are not suited to cultivation, but they are fertile and produce high yields of pasture. They have slow surface drainage and a slowly permeable to moderately permeable subsoil. The soils are—

Frio silty clay, frequently flooded.
Trinity clay, frequently flooded.

The main need of these soils is a permanent cover of plants that tolerate wetness. The less frequently flooded areas produce good yields of forage.

Bermudagrass, fescue, johnsongrass, and dallisgrass are suitable for pasture. Suitable legumes are buttonclover, sweetclover, alfalfa, and vetch. Alfalfa should be planted only on the better drained fields. Suitable for supplemental pasture is perennial ryegrass mixed with a legume. Because these soils are low in phosphorus, fields planted to legumes should receive phosphate fertilizer. Also needed is a regular application of nitrogen during the growing season.

CAPABILITY UNIT VIe-1

Ellis and Houston clays, 5 to 12 percent slopes, severely eroded, are the only soils in capability unit VIe-1. These soils are sloping to strongly sloping shaly clays that are severely eroded and shallow. Runoff is rapid; the subsoil is very slowly permeable. Erosion has removed the original surface layer and has exposed the subsoil and parent material in many places. Uncrossable gullies are common. The risk of erosion is very severe, and productivity has been reduced by the loss of surface soil.

The main need of these soils is a plant cover to control erosion. Grasses tolerant of droughtiness are suitable. Yields of King Ranch bluestem and native grasses are fair. Buttonclover and sweetclover are suitable legumes.

These soils are low in nitrogen and phosphorus. Pasture responds well when about 50 pounds of nitrogen and 60 pounds of phosphate per acre are added at planting time and nitrogen is applied regularly during the growing season. Because a height of about 6 inches is needed to keep pasture plants vigorous, stocking should be controlled to prevent grazing below that height.

CAPABILITY UNIT VIe-2

In capability unit VIe-2 are moderately deep, sloping to strongly sloping, calcareous clays. Runoff is rapid, and the subsoil is slowly permeable. Erosion has removed most of the original surface layer and has exposed the parent material in many places. Uncrossable gullies are common. The risk of erosion is severe, and productivity has been reduced by the loss of surface soil. The soils are—

Houston-Sumter complex, 5 to 8 percent slopes, severely eroded.
Sumter clay, 5 to 12 percent slopes, severely eroded.

The main need of these soils is a plant cover to control erosion. Grasses tolerant of droughtiness are suitable. These soils produce a fair yield of King Ranch bluestem and of native grasses. Suitable legumes are buttonclover and sweetclover.

These soils are low in nitrogen and phosphorus. Pasture responds well when about 50 pounds of nitrogen and 60 pounds of phosphate per acre are added at planting time and nitrogen is applied regularly during the growing season. Because a height of about 6 inches is needed to keep pasture plants vigorous, stocking should be controlled to prevent grazing below that height.

CAPABILITY UNIT VIe-3

Eddy soils, 3 to 8 percent slopes, eroded, are the only soils in capability unit VIe-3. These soils are very shallow, sloping gravelly clay loams. Runoff is medium to rapid. The subsoil is moderately permeable and is underlain by chalk bedrock. The risk of erosion is severe, and gullies are common. These soils are somewhat droughty.

The main need of these soils is a plant cover to control erosion. Grasses tolerant of droughtiness are suitable. These soils produce fair yields of King Ranch bluestem and native grasses. Buttonclover and sweetclover are suitable legumes.

These soils are low in nitrogen and phosphorus. Pasture responds well when about 50 pounds of nitrogen and 60 pounds of phosphate per acre are added at planting time and nitrogen is applied regularly during the growing season. Because a height of about 6 inches is needed to keep pasture plants vigorous, stocking should be controlled to prevent grazing below that height.

CAPABILITY UNIT VIe-4

Capability unit VIe-4 consists of moderately deep, sloping to strongly sloping, friable soils. These soils have medium or rapid runoff and a moderately permeable subsoil. The risk of erosion is severe, and gullies are common. These soils are droughty, and they are best suited to cool-season plants or native grasses. The soils are—

Broken alluvial land.
Lamar clay loam, 5 to 12 percent slopes, eroded.
Lewisville soils, 5 to 8 percent slopes, severely eroded.

The main need of these soils is a plant cover to control erosion. Suitable grasses are King Ranch bluestem, bermudagrass, and native grasses. Suitable legumes are buttonclover, sweetclover, and vetch.

These soils are low in nitrogen and phosphorus. Pastures respond well if they are fertilized at planting time with nitrogen and phosphate and nitrogen is applied regularly during the growing season.

CAPABILITY UNIT VIe-5

In capability unit VIe-5 are deep, sloping to strongly sloping soils that crust and have a clayey subsoil. Erosion has removed the surface layer and in places has exposed the parent material. Further erosion is likely. The subsoil is slowly permeable to very slowly permeable. The soils are medium acid. Good management, including selection of suitable plants, is needed to maintain a vegetative cover. These soils are—

Bates-Lamar complex, 5 to 12 percent slopes, eroded.
Crockett soils, 3 to 8 percent slopes, severely eroded.

Plants tolerant of medium acid soil can be grown on these soils. Suitable pasture grasses are bermudagrass, King Ranch bluestem, lovegrass, and mixed native grasses. Peas and vetch are suitable legumes.

These soils are low in nitrogen and phosphorus, and the surface layer does not contain enough lime for sweetclover. Pasture responds well if nitrogen and phosphate fertilizers are added at planting time and are applied regularly during the growing season. Adding lime increases the quality of forage.

CAPABILITY UNIT VIIe-1

Eddy soils, 8 to 20 percent slopes, are the only soils in capability unit VIIe-1. These soils are very shallow and strongly sloping to moderately steep. They are gravelly and are underlain by chalk bedrock at a depth of 6 to 15 inches. They contain narrow chalky ledges. In places erosion has removed their original surface layer and has exposed the bedrock. Slopes are too steep and the soils are too shallow for cultivation. In most places these soils are wooded. They are best suited to wildlife but can be used for pasture of native grasses.

Native plants are suited to these soils. Stocking should be controlled to prevent grazing the grasses below a height of 6 inches because that height is needed to keep them vigorous. Pasture is improved by removing mesquite and other undesirable woody plants. Grazing should be controlled so that a good growth of native plants is maintained.

CAPABILITY UNIT VIIe-2

In capability unit VIIe-2 are miscellaneous land types consisting of severely gullied soils and areas where gravel has been dug for use within the county. The land types within this unit are—

Gullied land.
Gravel pits.

These land types are best suited to wildlife habitats. They should be fenced to protect them from grazing, and eroded areas should be seeded. A firebreak of several furrows can be plowed around these areas to protect them.

Managing soils for hay and tame pasture

Management of pasture is important in Ellis County. Because interest in cattle production has increased, several hundred acres have been converted from crops to pasture. Conversion is mainly to warm-season grasses and cool-season legumes.

Both common and Coastal bermudagrass are used on deep soils; King Ranch and Caucasian bluestems are used on the shallow whiterock soils. Several other grasses are used in trials in the county. The most widely used legumes are hairy vetch and buttonclover. These are commonly overseeded in an established, low-yielding pasture of bermudagrass.

A well-managed pasture of bermudagrass produces about four times as much usable forage as the native grasses. The main management practices needed are fertilizing, controlling weeds, and controlling grazing. Fertilizers should be applied according to crop needs, as determined by soil tests. The pasture can be mowed when necessary to control weeds. Mowing generally is not needed if the pasture is well established and well managed, because the grasses crowd out the weeds in well-managed pasture. Pasture should not be grazed below the height that has been proved best for the kind of pasture. Ample cover should be left during winter to prevent erosion and to protect the grass roots. This cover prevents winterkilling and provides rapid growth in the spring. Compaction of the soil by trampling is reduced if the pasture is not overgrazed and if sufficient forage is left on the soil.

The amount of beef produced on a farm is determined mainly by the amount of forage the farm can produce. The forage in pasture can be increased by fertilizing, by planting winter legumes, by controlling weeds, and by controlling grazing. Temporary pasture is often used to supplement permanent pasture and to supply green forage in winter. Sudangrass and johnsongrass make good supplemental pasture in summer, and small grains are good for winter grazing.

Each pasture should have its own water, which a well or a pond can supply. Two or more pastures can be supplied from a pond or a well on a fence line.

A well-managed pasture generally has one main grass, is amply supplied with water, and is free of weeds. It is stocked according to the amount of forage available and is grazed only to a height that permits plants to remain vigorous.

The management of meadows for hay is important in Ellis county. The meadows are mainly in native grasses. Hay cut from these meadows is fed mostly to cattle. The yields of hay range from about 0.5 ton per acre to about 2 tons. The yields vary with the kinds of soil, the kinds of grass in the meadow, and the management.

Native grasses used in meadows are Indiangrass, big bluestem, little bluestem, switchgrass, side-oats grama, and dropseed. Also suitable in the meadows are Coastal bermudagrass, King Ranch bluestem, johnsongrass, and other tame grasses.

To produce satisfactory yields, a meadow must be managed well, for management of a meadow is just as important as management of cropland, pasture, or range. The practices used in managing meadows are about the same as those used in managing pasture.

Meadows should be cut at a height that has been proved best for the grasses used. Grasses that form sod can be mowed lower than the tall native grasses. Mowing too low or too often damages the meadow the same as overgrazing damages a pasture. Mowing at the appropriate height, however, leaves residue that is returned to the soil and helps to keep the soil productive. This residue mulches the surface of the soil and protects it. Mowing when the soil is wet may pack the surface soil and cause erosion and poor plant growth. Weeds can be controlled in meadows by mowing or by spraying with chemicals. Weed control is essential in establishing new meadows.

If meadows are seriously damaged by drought, by fire, or by poor management, they should not be cut but should be allowed to grow all season. Then the grasses reestablish a strong root system and become vigorous. Weakened grasses are easily winterkilled, and the meadow is then easily invaded by weeds.

Commercial fertilizer improves meadows of bermudagrass, johnsongrass, King Ranch bluestem, and other tame grasses. Well-established native grasses generally can be kept vigorous by good management that does not include fertilizing. Meadows can be established on all soils in the county except some of the steeper ones.

Meadows are best suited to deep, fertile soils. Management is easiest if the surface is smooth. If the soils are eroded or are low in organic matter, legumes should be grown on them 1 or more years before establishing a meadow. Meadow can be established easily on soils that are in good tilth and are free of weeds.

Managing Soils for Range

The purpose of this subsection is to furnish guides to help ranchers manage rangeland profitably. The soils of the county are grouped into range sites that produce significantly different kinds or amounts of native plants.

About 50,000 acres of rangeland in Ellis County is used to produce native plants. These areas are not well suited to tame pasture. They are mainly in the rougher parts of the county where seeding, fertilizing, and mowing pasture are impractical. The soils are shallow, steep, eroded, wooded, or flooded, or they have a combination of these limiting characteristics. Range is grazing land that, without cultural practices, is used to grow native plants. Range, however, is managed, and under good management livestock can be produced economically.

Range sites and condition classes

A range site is a kind of rangeland that has a different potential for growing native forage plants than have other kinds of rangeland. It is a land area with a distinct combination of soils, topography, drainage, and climate. Because of these characteristics, the soils in a range site produce a definite combination of plants in fairly uniform amounts. The plants that originally grew on the site are generally the most productive combination of native plants that can grow there. This combination of plants is called the climax vegetation.

Climax vegetation consists mainly of two classes of plants, decreasers and increasers. Livestock prefer to graze decreasers, and the decreasers are first to be eliminated when a range is overgrazed. Increasers are second-choice plants and withstand grazing better. They increase and replace the decreasers. If overgrazing continues for prolonged periods, the increasers are destroyed and are replaced by invaders. Invaders are plants that did not occur in the original vegetation or occurred in small quantities. They become established after climax vegetation has been reduced by grazing.

Native range grasses respond to good management in the same ways as other crops. To get the most from rangeland requires (1) selecting livestock best suited to grazing the range, (2) limiting the number of livestock and the time the range is grazed, and (3) controlling the distribution of grazing animals. The rangeland in Ellis County is grazed mainly by cattle. The number grazed can be determined by the length of time the range will be grazed and the amount of forage available. The forage available depends on the condition of the range.

Four range condition classes are used to indicate the kinds and amount of plants growing on the range in relation to the kinds and amount that grew on it originally. A range is in *excellent* condition if 76 to 100 percent of its vegetation is the kind that grew on it originally. Condition is *good* if the percentage is 51 to 75; it is *fair* if the percentage is 26 to 50; and it is *poor* if the percentage is 0 to 25. In overgrazed areas the climax vegetation is replaced by less desirable plants, and the condition is poor.

The condition of the range affects the kinds and amounts of grasses a range site produces and the best time for grazing the site. If the range is in poor or fair condition, resting it during spring and summer permits the better grasses to spread by underground stems and by seeding. If the range is in good or excellent condition, occasional resting helps maintain a vigorous growth.

Technicians of the Soil Conservation Service are available to assist with problems of range management. Among these problems are selecting suitable grasses and seeding rates; stocking at appropriate rates; grazing at proper times; distributing salt and minerals; establishing water facilities; and controlling weeds and brush.

Range sites in Ellis County

Described in the following pages are the range sites in the county. The soils in each range site are described generally, and the important grasses of the climax vegetation are named.

ROLLING BLACKLAND RANGE SITE

This range site consists of deep, nearly level or gently sloping soils. These soils are slightly to moderately eroded and are dominantly calcareous clays. Because most of them crack severely when they dry, the water intake is increased. Runoff is fairly slow in grass-covered areas, and the nearly level areas are ponded. These soils have a moderate to high capacity for storing moisture, and they are productive. Many narrow strips along streams are wooded. The soils are—

Austin silty clay, 1 to 3 percent slopes (AuB).
Austin silty clay, 3 to 5 percent slopes, eroded (AuC2).
Austin silty clay, 5 to 8 percent slopes, eroded(AuD2).
Broken alluvial land (Br).
Houston clay, 1 to 3 percent slopes (HcB).
Houston clay, 3 to 5 percent slopes, eroded (HcC2).
Houston clay, 5 to 8 percent slopes, eroded (HcD2).
Houston Black clay, 0 to 1 percent slopes (HaA).
Houston Black clay, 1 to 3 percent slopes (HaB).
Houston Black clay, terrace, 0 to 1 percent slopes (HbA).
Houston Black clay, terrace, 1 to 3 percent slopes (HbB).
Hunt clay, 0 to 1 percent slopes (HuA).
Hunt clay, 1 to 3 percent slopes (HuB).
Lamar clay loam, 2 to 5 percent slopes, eroded (LaC2).
Lamar clay loam, 5 to 12 percent slopes, eroded (LaE2).
Lewisville association, 1 to 3 percent slopes (LwB).
Lewisville association, 3 to 5 percent slopes, eroded (LwC2).
Lewisville association, 5 to 8 percent slopes, eroded (LwD2).
Lewisville silty clay, 0 to 1 percent slopes (LeA).
Lewisville silty clay, 1 to 3 percent slopes (LeB).
Lewisville silty clay, 3 to 5 percent slopes, eroded (LeC2).
Lewisville silty clay, 5 to 8 percent slopes, eroded (LeD2).

The important grasses in the climax vegetation are big bluestem, little bluestem, Indiangrass, switchgrass, Virginia wild-rye, side-oats grama, meadow dropseed, silver bluestem, and Texas wintergrass (*12*). These grasses and climax forbs make up about 75 percent of the vegetation on this site. Generally, in the eroded or heavily grazed areas, there are side-oats grama, silver bluestem, Texas wintergrass, buffalograss, and similar grasses.

Yields vary according to range condition and the way the range is managed. In an average year, well-managed range in excellent condition produces an estimated 13,000 pounds of herbage per acre; in good condition, 9,000 pounds; in fair condition, 6,000 pounds; and in poor condition, 4,000 pounds.

GULLIED BLACKLAND RANGE SITE

This range site is made up of deep and moderately deep soils. Dominant slopes are 3 to 10 percent. Erosion has removed the original surface layer from about 50 percent of the area and has cut uncrossable gullies in many of the more eroded places. In this site are clays, silty clays, and clay loams that are high in lime. These soils produce range plants of high quality, but they have been eroded so much that their original productiveness has been reduced about 40 percent. The soils are—

Gullied land (Gl).
Lewisville soils, 5 to 8 percent slopes, severely eroded (LsD3).
Sumter clay, 5 to 12 percent slopes, severely eroded (SuE3).
Houston-Sumter complex, 5 to 8 percent slopes, severely eroded (HsD3).

The dominant grasses in the climax vegetation are little bluestem, Indiangrass, big bluestem, tall dropseed, meadow dropseed, side-oats grama, and silver bluestem.

Yields vary according to range condition and the way the range is managed. In an average year, well-managed range in excellent condition produces an estimated 9,000 pounds of herbage per acre; in good condition, 7,000 pounds; in fair condition, 4,500 pounds; and in poor condition, 3,000 pounds.

GRAYLAND RANGE SITE

This range site is made up of soils that have a dense, clay subsoil. Slopes are dominantly 1 to 6 percent. Erosion has removed the original surface soil from about 50 percent of the area. The surface layer of these soils seals readily. Because water stands in flat areas only for short periods and runs off of slopes rapidly, rainfall is not very effective and the soils are droughty. Consequently, intensive management is needed to reestablish the climax vegetation. The soils on this site are—

Bates fine sandy loam, 3 to 5 percent slopes, eroded (BaC2).
Bates-Lamar complex, 5 to 12 percent slopes, eroded (BcE2).
Burleson clay, 0 to 1 percent slopes (BuA).
Burleson clay, 1 to 3 percent slopes (BuB).
Burleson clay, depressional (By).
Burleson clay, terrace, 0 to 1 percent slopes (BtA).
Burleson clay, terrace, 1 to 3 percent slopes (BtB).
Crockett soils, 2 to 5 percent slopes, eroded (CrC2).
Crockett soils, 3 to 8 percent slopes, severely eroded (CrD3).
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes (DsB).
Payne clay loam, 0 to 2 percent slopes (PcA).
Payne and Norge soils, 1 to 3 percent slopes (PnB).
Pratt loamy fine sand, terrace, 0 to 3 percent slopes (PrA).
Wilson clay loam, 0 to 1 percent slopes (WsA).
Wilson clay loam, 1 to 3 percent slopes (WsB).
Wilson clay loam, 1 to 3 percent slopes, eroded (WsB2).
Wilson clay loam, terrace, 0 to 1 percent slopes (WtA).
Wilson clay loam, terrace, 1 to 3 percent slopes (WtB).
Wilson fine sandy loam, 0 to 1 percent slopes (WfA).
Wilson fine sandy loam, 1 to 3 percent slopes (WfB).

The important grasses in the climax vegetation are little bluestem, Indiangrass, big bluestem, side-oats grama, Carolina joint-tail, meadow dropseed, silver bluestem, and Texas wintergrass.

Yields vary according to range condition and the way the range is managed. In an average year, well-managed range in excellent condition produces an estimated 4,500 pounds of herbage per acre; in good condition, 3,800 pounds; in fair condition, 3,000 pounds; and in poor condition, 2,500 pounds.

CHALKY RIDGE RANGE SITE

This range site is made up of very shallow and shallow clays and clay loams that are high in lime. Slopes are dominantly 2 to 12 percent. Erosion has removed the original surface soil from about 50 percent of the area. Because these soils are shallow and eroded, they can produce only a small amount of usable forage. The soils are—

Brackett and Austin soils, 2 to 5 percent slopes, eroded (BkC2).
Eddy gravelly clay loam, 1 to 3 percent slopes (EcB).
Eddy soils, 3 to 8 percent slopes, eroded (EdD2).
Eddy soils, 8 to 20 percent slopes (EdF).
Stephen silty clay, 1 to 3 percent slopes (StB).
Stephen-Eddy complex, 1 to 3 percent slopes, eroded (SeB2).
Stephen-Eddy complex, 3 to 5 percent slopes, eroded (SeC2).

The dominant climax grasses on this site are little bluestem, side-oats grama, tall dropseed, slim tridens, silver bluestem, and low-growing panicums.

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Yields vary according to range condition and the way the range is managed. In an average year, well-managed range in excellent condition produces an estimated 3,600 pounds of herbage per acre; in good condition, 3,000 pounds; in fair condition, 2,500 pounds; and in poor condition, 2,000 pounds.

SHALY HARDLAND RANGE SITE

This range site is made up of shallow to deep, dense, shaly clays. Slopes are dominantly 2 to 10 percent. Erosion has removed the original surface soil from most of the area and has cut many uncrossable gullies. Crusting is common, and fertility and the organic-matter content are low. Water moves through these soils slowly, and aeration is poor. Because of these characteristics, revegetation is difficult. Intensive management is required to reestablish plants and to keep these soils productive. The soils are—

Ellis and Houston clays, 3 to 5 percent slopes, eroded (EhC2).
Ellis and Houston clays, 5 to 12 percent slopes, severely eroded (EhE3).
Houston and Ellis clays, 1 to 3 percent slopes (HmB).

Dominant plants in the climax vegetation are little bluestem, Indiangrass, side-oats grama, vine-mesquite, low-growing panicums, silver bluestem, plains lovegrass, Texas wintergrass, and forbs.

Yields vary according to range condition and the way the range is managed. In an average year, well-managed range in excellent condition produces 7,600 pounds of herbage per acre; in good condition, 6,400 pounds; in fair condition, 4,200 pounds; and in poor condition, 3,000 pounds.

BOTTOMLAND RANGE SITE

This range site is made up of deep clays, silty clays, and loam that washed from blackland soils. Slopes in most places are less than 1 percent. About one-third of the area is flooded frequently. The water covers grasses and low woody plants and kills the grasses. Hardwoods shade about 90 to 95 percent of this frequently flooded area and hinder growth of warm-season grasses. Cool-season plants, however, grow well while the hardwoods are dormant. Consequently, this site is suitable mainly for winter grazing. The soils are—

Frio loam (Fl).
Frio silty clay, frequently flooded (Fr).
Frio silty clay, occasionally flooded (Fs)
Trinity clay, frequently flooded (Tc).
Trinity clay, occasionally flooded (To).
Trinity clay, wet (Tr).
Trinity clay, loamy substratum (Ts).

The climax vegetation consists mainly of hardwoods, including a few large trees. In open areas, the climax vegetation was switch cane, eastern gamagrass, redtop panicum, beaked panicum, large sedges, switchgrass, vine-mesquite, and meadow dropseed. In dense wooded areas, the dominant understory consists of Virginia wildrye, sedges, low-growing panicums, and winter annuals. Because flooding and silting decrease the vegetation on these flooded soils, more herbage is available in dry years.

Yields vary according to range condition, the way the range is managed, and the amount of shade. If the shade does not exceed 30 percent, in an average year well-managed range in excellent condition produces an estimated 4,500 pounds of herbage per acre; in good condition, 3,600 pounds; in fair condition, 3,000 pounds; and in poor condition, 2,000 pounds.

Managing Soils for Wildlife

Among the many kinds of wildlife in Ellis County are deer, squirrel, rabbit, quail, dove, waterfowl, and fish. All game animals are increasing. This increase is a result of many farm families moving to town and their fields, formerly used for row crops, growing up in grass. Grassland is a better habitat for game than cropland. Also, many farmsteads that have been abandoned provide cover for wildlife.

The number of deer in the county has increased from about 50 in 1940 to an estimated 2,500 to 3,000 in 1960. The deer killed in 1960 numbered 407. In that year deer hunters leased about 12,000 acres for approximately $13,000.

The deer in the county are in the wooded part of the whiterock area. They are most numerous in the community of Bell Branch. Land use in this area is favorable to deer herds because most of the area is used to raise livestock. On the ridges are mainly Eddy and Stephen soils. The rolling pastures in this area have many patches of brush that furnish food and cover for deer. In areas dissected by narrow, wooded valleys are Austin soils and Broken alluvial land. The larger flood plains are wooded in most places and contain Frio and Trinity soils. The cultivated fields are mainly Austin, Eddy, and Stephen soils and are generally in small grains and feed crops. These fields are scattered throughout the area and provide grazing for deer. The combination of soils and their use for woods, pasture, and cultivated crops provide a variety of food for deer, including grass, browse, acorns, and field crops.

Quail are most numerous in the western and southwestern parts of the county. The number of quail varies from year to year because the weather may be unfavorable during the nesting season, because food is sometimes scarce, because disease may break out, and because cover may not be adequate to protect the quail from their natural enemies. However, their number can be increased by managing the soils to provide food and cover.

Crops that provide good food for quail are sesame, small grains, millet, grain sorghum, corn, sorghum almum, and peas. These crops are widespread throughout the county and do well on most of the soils.

Many native plants also supply food for quail during much of the year. Among these plants are annual panicum and paspalum, sunflower, snow-on-the-mountain, ragweed, and crotonweed. These plants are suited to most soils in the county. Annual panicum and snow-on-the-mountain do well on the Austin, Eddy, Lamar, Lewisville, Stephen, and other droughty soils. These plants can be encouraged in abandoned pasture by disking the soil to help seeds germinate, to control competing plants, and to establish a stand. Crotonweed usually invades fields after a small grain is harvested. It produces a seed crop if plowing these fields is delayed until fall.

Johnsongrass seed provides food for quail and is eaten in dry years when some of the other food is scarce. This grass is common throughout the county, except where it is controlled in clean-tilled fields, in wooded areas, or in pastures of native grass.

Sorghum almum produces a large amount of seed and usually a dense growth of foliage, which gives good protection to quail. It grows adequately on most soils in the county, but it grows best on Houston Black clay and other fertile soils. After 3 or 4 years, sorghum almum thins out in many places and the amount of cover is reduced, but the thin stands still provide much food.

In Ellis County dove is hunted more than is any other game. If feed is provided, doves are encouraged to stay in an area. They are especially attracted to fields in which sesame is grown. Sesame is suited to all soils in the county that are smooth enough to be plowed and seeded. Odd areas, field borders, and other small plantings of food crops help to keep the birds in the area. Doves generally eat about the same kind of seeds as quail.

Water is also needed to hold doves in an area. These birds like to drink after they eat and before they fly to the woods to roost. They prefer a stream, a farm pond, or other fairly clean area where they can light at the edge and drink. A field that contains adequate food and water and is close to a wooded area is ideal for doves. Feeding areas should be provided from fall to spring.

The county has ample areas of water suitable for waterfowl. At present there are approximately 5,500 farm ponds; 49 floodwater retarding lakes that range in surface area from 6 to 208 acres; Lake Waxahachie, which has a surface area of about 700 acres; and many small city lakes. Other floodwater retarding lakes are scheduled for construction.

Areas that are flooded intermittently and areas adjacent to water can be planted as feeding places for waterfowl. These areas can be seeded to plants that furnish good food for ducks. Among these plants are corn, browntop millet, sweet sorghum, and grain sorghum. Areas where the water level can be controlled are best. In these areas the water can be lowered, and the crop seeded and allowed to grow to maturity. Because ducks like to feed under water, the field can be flooded in the fall and winter. Thus ducks are encouraged to stay in the area instead of moving to other feeding places.

Some native plants that produce suitable food for ducks are smartweed, Japanese millet, and duck potato. These plants grow on wet soils, mainly near the water's edge. The soils should be flooded to provide a feeding area for the ducks.

Geese use bodies of water for resting areas and for protection, but they feed mainly on cropland and pastures. They eat both the green plants and the seed of small grains, vetch, sweetclover, fescue, and wintergrowing annual weeds. These plants commonly grow on most soils in the county. Plantings close to areas of water help to keep geese in the area.

Bodies of water in Ellis County provide many places to fish. Fishing for bass, bream, and channel catfish is popular. These fish have been stocked in most of the floodwater retarding lakes, city lakes, private lakes, and larger farm ponds. The farm ponds and smaller lakes can be fertilized to increase production of fish.

Engineering Applications [2]

This soil survey report contains information about the soils of Ellis County that engineers can use. Special emphasis has been placed on engineering properties as related to agriculture, particularly those that affect structures to control soil erosion and to conserve water. Information in this report can be used to—

1. Make preliminary estimates of the engineering properties of soils for use in planning farm ponds, irrigation systems, or other structures for soil and water conservation.
2. Make studies of soil and land use that will aid in the selection and development of industrial, business, residential, and recreational sites.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and other engineering structures, and in planning detailed soil investigations of the selected sites.
4. Locate probable sources of gravel, sand, topsoil, and other materials for use in structures.
5. Correlate performance of engineering structures with kinds of soil and thus develop information that will be useful in the design and maintenance of the structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement information from other published maps, reports, and aerial photographs in making maps and reports that can be used readily by engineers.
8. Develop preliminary estimates for other construction purposes in a particular area.

The interpretations are necessarily generalized. Without further tests and sampling, the information in this report is not adequate for design and construction of specified engineering works.

Much of the information in this subsection is in tables 3, 4, and 5. In table 3 are engineering descriptions of each soil in the county and estimates of physical properties significant in engineering. Table 4 is an engineering interpretation of the soils in the county, and table 5 lists test data of selected soils.

Some of the terms used by the soil scientist may have a special meaning in soil science, and some terms may be unfamiliar to the engineer. These terms are defined in the Glossary at the back of this report.

Soils in conservation engineering

The technician who uses soil in various conservation structures needs to know the suitability of each soil for those structures. Soil features that affect dikes and levees, farm ponds, and terraces and diversions are given in table 4, beginning on page 48. A discussion of these structures, and of drainage, irrigation, and gully control, may be useful.

[2] N. M. FAULK, engineering specialist, Soil Conservation Service, assisted in writing this section.

Dikes and levees.—Engineers need to know if the binding properties and internal friction of the soils are favorable for constructing a stable embankment. Soil permeability should be known in order to design the embankment so that the phreatic surface, or line of saturation, intersects the normal ground line within the base of the embankment. General knowledge is useful, but a detailed soil analysis is needed for most embankments, especially for those more than 15 feet high.

Farm ponds.—The technician needs to know if the sides and bottom of a farm pond will hold water. Soils that have adequate depth, good binding properties, good internal friction, and low permeability are suitable for embankments and for reservoir areas. A stratum of porous material in the reservoir area must be sealed with a layer of slowly permeable clay or must be treated with amendments that seal the permeable stratum. A general knowledge of the soil is useful because this knowledge enables one to evaluate a pond site.

Terraces.—A soil suitable for terraces should contain enough binding material with low to medium shrink-swell potential to prevent washing and to prevent water from flowing through a crack in the terrace ridge. The Eddy, Pratt, Dougherty, and Stidham soils do not have sufficient binding material and are not suitable for terraces. The Eddy soils are shallow and consist of less than 8 inches of gravelly clay loam over limestone. The Pratt, Dougherty, and Stidham soils are loamy fine sands and are too permeable.

Waterways.—Shallow soils are not suitable for waterways, because at least 18 inches of soil is needed above the contrasting material of rock, chalk, marl, or shale. The depth of some soils to contrasting material is given in the column "Reservoir area" in table 4. After a waterway has been built, it is very difficult to establish perennial grasses on shallow soils and to keep the grass dense. Severely eroded soils require annual applications of a complete fertilizer if they are to maintain a well-grassed waterway.

Drainage.—Engineers need to know the properties of underlying materials so that unstable materials in drainage ditches are not exposed to the action of running water. The soil material should be binding enough that the ditchbanks do not erode when ditches are designed for a specified velocity. Soils in Ellis County that need drainage are generally on the flood plain of larger streams. Such a soil is Trinity clay. Also requiring drainage are a few nearly level soils with very slow surface runoff. Examples of these soils are Burleson clay; Houston Black clay; Houston Black clay, terrace; and Wilson clay loam, terrace. The main need of these soils is rows that run toward the lower areas or into a prepared waterway.

Irrigation.—Water is available for irrigation on most of the soils on bottom land and can be applied by sprinkling or by flooding. The border or furrow system of irrigation is especially well suited to fine-textured soils that crack when they dry. A large amount of water applied initially is most desirable to fill the cracks before the soil swells and seals the cracks. Sprinklers can be used to irrigate all soils, but they are best suited to the Pratt, Dougherty, Stidham, Frio, and other coarser textured soils. Water is not available for irrigation of soils on uplands.

TABLE 3.—*Description of soils and*

Soils[1]	Depth to contrasting materials	Soil description and hydrologic group	Depth from surface in typical profile
	Feet		*Inches*
Austin silty clay, 1 to 3 percent slopes	4.0 to chalky marl	20 to 40 inches of well-drained, strongly calcareous clay from chalky bedrock that contains joints or fissures in about 50 percent of the acreage; chalk fragments in some thin soils; gray areas rich in calcium carbonate; surface and internal drainage medium. Hydrologic group A.	0 to 16 16 to 42
Austin silty clay, 3 to 5 percent slopes, eroded.	3.5 to chalky marl		
Austin silty clay, 5 to 8 percent slopes, eroded.	3.0 to chalky marl		
Bates fine sandy loam, 3 to 5 percent slopes, eroded.	6.0+ to sandstone	4 to 12 inches of slightly acid to neutral, well-drained fine sandy loam underlain by weak, blocky sandy clay; parent material is sandy clay that erodes readily; weakly cemented sandstone at a depth of 6 to 10 feet in places. Hydrologic group C.	0 to 9 9 to 36 36 to 60
Bates-Lamar complex, 5 to 12 percent slopes, eroded (Bates component).	6.0+ to sandstone		
Brackett and Austin soils, 2 to 5 percent slopes, eroded (Brackett component).	2.5 to chalky marl	12 to 26 inches of well-drained, strongly calcareous silty clay that derived from chalky marl and is rich in calcium carbonate; grade to platy chalky marl; medium surface drainage and slow internal drainage. Hydrologic group B.	0 to 30
Broken alluvial land	3 to 15 to chalk	About 8 feet of strongly sloping, strongly calcareous, well-drained silty clay that grades to stratified gravelly material in places; underlying material is chalk; good surface drainage and medium internal drainage. Hydrologic group B.	0 to 60
Burleson clay, 0 to 1 percent slopes	5.0 to marl	4 to 6 feet of noncalcareous, dense, massive clay from old alluvium on terraces, on ridgetops, and in depressions; nearly level areas somewhat poorly drained; depressions ponded in wet periods; about 72 percent of area underlain by water-bearing, stratified sand and gravel at a depth of 6 to 20 feet; surface and internal drainage slow. Hydrologic group D.	0 to 4 4 to 12 12 to 40 40 to 60
Burleson clay, 1 to 3 percent slopes	5.0 to marl		
Burleson clay, depressional	5+ to sand and gravel.		
Burleson clay, terrace, 0 to 1 percent slopes	7+ to sand and gravel.		
Burleson clay, terrace, 1 to 3 percent slopes	8+ to sand and gravel.		
Crockett soils, 2 to 5 percent slopes, eroded	4.0 to clayey marl	4 to 10 inches of medium acid clay loam or fine sandy loam over heavy clay; about 70 percent of area is clay loam; solum is less than 4 feet thick in most places and grades to clayey marl; slickspots and saline areas common; medium to rapid surface drainage and very slow internal drainage. Hydrologic group D.	0 to 5 5 to 38 38 to 44 44 to 70
Crockett soils, 3 to 8 percent slopes, severely eroded.	4.0 to clayey marl	4 to 10 inches of medium acid clay loam or fine sandy loam over heavy clay; clay loam in about 70 percent of the area; solum less than 4 feet thick in most places and grades to clayey marl; slickspots and saline areas common; medium to rapid surface drainage and very slow internal drainage. Hydrologic group D.	0 to 5 5 to 18 18 to 34 34 to 48
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes (Dougherty loamy fine sand component).	7.0+ to clay	6 to 14 inches of loamy fine sand that grades to clay loam at about 15 inches; soil occurs on low terraces and is slightly mounded; rapid surface and internal drainage. Hydrologic group B.	0 to 9 9 to 15 15 to 36 36 to 60
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes (Stidham component).	7.0+ to clay	15 to 25 inches of loamy sand over sandy clay on low terraces; low mounds on surface; rapid internal drainage. Hydrologic group B.	0 to 20 20 to 30 30 to 48 48 to 60
Eddy gravelly clay loam, 1 to 3 percent slopes.	0.8 to chalk	2 to 8 inches of gravelly clay loam over chalk bedrock that has joints or fissures in about 50 percent of area; solum contains as much as 40 percent chalk fragments in places. Hydrologic group C.	0 to 6 6+
Eddy soils, 3 to 8 percent slopes, eroded	0.8 to chalk		
Eddy soils, 8 to 20 percent slopes	1.0 to chalk		

See footnote at end of table.

their estimated physical properties

Classification			Percentage passing sieve—			Perme-ability	Available water capacity	Reaction (pH)	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
							Inches per inch of soil		
Silty clay	CH or CL	A-7-5	100	95	85	1. 0 -2. 0	0. 125	7. 8-8. 3	Medium to high.
Silty clay	CH or CL	A-7-6	100	95	85	1. 0 -2. 0	. 125	8. 0-8. 3	Medium to high.
Fine sandy loam	CL-ML	A-4	100	100	75	0. 7 -1. 5	. 083	6. 0-7. 2	Low to medium.
Sandy clay	CL	A-6	100	100	80	0. 7 -1. 5	. 125	4. 8-5. 8	Medium.
Sandy clay loam	CL	A-6	100	100	80	0. 7 -1. 5	. 10	5. 0-6. 0	Medium.
Silty clay	CH or CL	A-7-6	100	80-95	75-90	0. 75-1. 0	. 083	8. 0-8. 3	Medium to high.
Silty clay	CL	A-6	100	100	85	1. 0 -2. 0	. 133	8. 0-8. 3	Medium.
Clay	CH	A-7-6	100	100	82-97	0. 15-0. 5	. 146	5. 8-8. 0	High.
Clay	CH	A-7-6	100	100	84-96	0. 25-0. 75	. 146	6. 0-8. 0	High.
Clay	CH	A-7-6	100	100	83-94	0. 25-0. 75	. 146	6. 0-8. 0	High.
Clay	CH	A-7-6	95-100	92-100	83-94	0. 25-0. 75	. 146	7. 0-8. 0	High.
Clay loam and fine sandy loam.	CL	A-6	100	95	85	0. 5 -0. 75	. 104	5. 5-6. 2	Medium.
Clay	CH	A-7-6	88	88	68	0. 3 -0. 6	. 125	5. 0-6. 5	Medium.
Clay	CL-CH	A-7-6	94	90	72	0. 3 -0. 6	. 125	5. 0-6. 5	Medium.
Clay	CL-CH	A-7-6	94	90	72	0. 3 -0. 6	. 125	6. 0-7. 0	Medium.
Fine sandy loam	CL-ML	A-4	89	87	54	0. 6 -1. 0	. 083	5. 5-6. 2	Low.
Clay	CH	A-7-6	89	87	68	0. 3 -0. 6	. 083	6. 0-7. 0	Medium.
Clay	CH	A-7-6	88	88	72	0. 3 -0. 6	. 125	7. 0-8. 0	Medium.
Clay	CL-CH	A-7-6	94	90	72	0. 3 -0. 6	. 125	7. 5-8. 2	Medium.
Loamy fine sand	SM	A-2	100	100	35	2. 0 -4. 0	. 060	5. 8-6. 2	Very low.
Loam	CL or ML	A-4	100	100	60	1. 25-2. 5	. 080	6. 2-6. 8	Very low.
Clay loam	CH	A-6	100	100	75	0. 5 -1. 0	. 115	6. 0-6. 5	Medium.
Clay loam	CL	A-6	100	100	75	0. 5 -1. 0	. 115	5. 8-6. 2	Medium.
Loamy fine sand	SM	A-2	100	100	35	2. 0 -4. 0	. 063	6. 0-6. 8	Very low.
Sandy clay	SM or CL	A-4	100	100	50	1. 0 -2. 0	. 104	5. 8-7. 0	Very low.
Sandy clay	SM or CL	A-4	100	100	50	1. 0 -2. 0	. 104	6. 0-7. 0	Very low.
Sandy clay loam	SM or CL	A-4	100	100	50	1. 0 -2. 0	. 083	6. 5-7. 5	Very low.
Gravelly clay loam.	CL	A-6	90	80	70	1. 0 -2. 5	. 125	7. 6-8. 3	Medium.
Chalk	----------	----------	----------	----------	----------	----------	----------	----------	

TABLE 3.—*Description of soils and their*

Soils[1]	Depth to contrasting materials	Soil description and hydrologic group	Depth from surface in typical profile
	Feet		*Inches*
Ellis and Houston clays, 3 to 5 percent slopes, eroded (Ellis component). Ellis and Houston clays, 5 to 12 percent slopes, severely eroded.	2.5 to shale 2.0 to shale	15 to 30 inches of dense, calcareous clay over Eagle Ford shale that is weathered in the upper part in most places; solum contains gypsum crystals; limestone in places 8 to 12 inches thick above shale. Hydrologic group D.	0 to 7 7 to 10 10 to 28
Frio loam (0 to 1 percent slopes)	10+ to sand and gravel.	1 to 3 feet of loam over coarse material or silty clay; in strongly calcareous alluvium on flood plain of streams flowing from the blackland prairie; chalk bedrock at a depth of 8 to 12 feet in places. Hydrologic group C.	0 to 14 14 to 32 32 to 46 46 to 60
Frio silty clay, frequently flooded Frio silty clay, occasionally flooded	10+ to sand and gravel. 10+ to sand and gravel.	4 to 6 feet of well-drained, strongly calcareous silty clay alluvium on flood plain of streams flowing from blackland prairie; stratified coarse material at a depth of about 4 feet in places; in other places chalk bedrock is at a depth of 8 to 12 feet. Hydrologic group B.	0 to 8 8 to 12 12 to 60
Houston clay, 1 to 3 percent slopes Houston clay, 3 to 5 percent slopes, eroded Houston clay, 5 to 8 percent slopes, eroded	4+ to shale 4+ to shale 4+ to shale	3 to 5 feet of heavy calcareous clay over clayey marl or clayey shale; thinnest soils are most sloping; medium to rapid surface drainage and slow internal drainage. Hydrologic group D.	0 to 9 9 to 34 34 to 46
Houston and Ellis clays, 1 to 3 percent slopes.	3.5 to shale	15 to 30 inches of dense, mostly calcareous clay mainly over Eagle Ford shale; in places over platy marl; upper 12 inches of shale weathered; clay and shale contain many crystals of gypsum; in places thin soils contain limestone 8 to 12 inches thick above the shale; medium to rapid surface drainage and very slow internal drainage. Hydrologic group D.	0 to 5 5 to 28 28 to 36 36+
Houston Black clay, 0 to 1 percent slopes Houston Black clay, 1 to 3 percent slopes	5+ to chalk 6+ to chalk	4 to 7 feet of heavy calcareous clay over marl, clayey shale, or chalk; thinnest soils underlain by chalk; deep soils underlain by marl grade to clayey marl; nearly level areas poorly drained; medium surface drainage and slow internal drainage. Hydrologic group D.	0 to 40 40 to 70 70 to 80
Houston Black clay, terrace, 0 to 1 percent slopes. Houston Black clay, terrace, 1 to 3 percent slopes.	10+ to sand and gravel. 10+ to sand and gravel.	4 to 6 feet of calcareous clay in strongly calcareous, old alluvium; nearly level areas are somewhat poorly drained in places; about 50 percent of area underlain by beds of water-bearing, stratified sand and gravel at a depth of 10 to 30 feet; slow surface and internal drainage. Hydrologic group D.	0 to 60
Hunt clay, 0 to 1 percent slopes Hunt clay, 1 to 3 percent slopes	6+ to marl 6+ to marl	4 to 6 feet of moderately well drained heavy clay over clayey marl; hard, rounded pebbles about 2 inches in diameter in many places; slow surface and internal drainage. Hydrologic group D.	0 to 7 7 to 16 16 to 28 28 to 60
Lamar clay loam, 2 to 5 percent slopes, eroded. Lamar clay loam, 5 to 12 percent slopes, eroded.	4+ to marl 4+ to marl	3 to 5 feet of rolling to strongly sloping, strongly calcareous clay loam underlain by platy clayey marl; medium to rapid surface drainage; internal drainage medium in clay loam and very slow in platy marl. Hydrologic group B.	0 to 16 16 to 36 36 to 62
Lewisville association, 1 to 3 percent slopes (Lewisville component). Lewisville association, 3 to 5 percent slopes, eroded (Lewisville component). Lewisville association, 5 to 8 percent slopes, eroded (Lewisville component).	5+ to sand and gravel. 5+ to sand and gravel. 5+ to sand and gravel.	3 to 5 feet of strongly calcareous, well-drained loam or sandy clay in old alluvium; gravel at a depth of 3 to 15 feet suitable for structures; good surface drainage but seeps and springs numerous, mainly along boundary of lower slope. Hydrologic group B.	0 to 8 8 to 18 18 to 60

See footnote at end of table.

estimated physical properties—Continued

Classification			Percentage passing sieve—			Perme-ability	Available water capacity	Reaction (pH)	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
							Inches per inch of soil		
Clay	CH	A-7-5	99-100	97-99	90-96	0. 1 -0. 6	0. 125	7. 0-8. 0	High.
Clay	CH	A-7-5	99-100	97-99	90-96	0. 1 -0. 6	. 125	7. 0-8. 0	High to very high.
Clay	CH	A-7-6	99-100	97-99	90-96	0. 1 -0. 6	. 125	5. 0-7. 5	High to very high.
Loam	CL-ML	A-4 or A-6	100	100	75	1. 25-2. 5	. 083	7. 8-8. 3	Low to medium.
Loam	CL-ML	A-4 or A-6	100	100	75	1. 25-2. 5	. 083	8. 0-8. 3	Low to medium.
Clay loam	CL	A-6	100	100	75	1. 25-2. 5	. 125	8. 0-8. 3	Medium.
Clay	CH	A-7	100	100	80	1. 25-2. 5	. 167	8. 0-8. 3	High.
Silty clay	CH or CL	A-6 or A-7	100	100	80	0. 9 -1. 8	. 125	7. 8-8. 3	Medium.
Silty clay	CH or CL	A-6 or A-7	100	100	80	0. 9 -1. 8	. 125	8. 0-6. 3	Medium.
Silty clay	CH or CL	A-6 or A-7	100	100	80	0. 9 -1. 8	. 125	8. 0-8. 3	Medium.
Clay	CH	A-7-6	100	100	89	0. 3 -0. 7	. 158	7. 8-8. 3	High.
Clay	CH	A-7-6	100	100	89	0. 3 -0. 7	. 150	7. 8-8. 3	Very high.
Clay	CH	A-7-6	80-100	67-99	70-99	0. 3 -0. 7	. 150	7. 8-8. 3	Very high.
Clay	CH	A-7-6	100	100	89	0. 3 -0. 7	. 158	7. 8-8. 3	High.
Clay	CH	A-7-5	99-100	97-99	90-96	0. 1 -0. 6	. 125	7. 5-8. 0	High to very high.
Shaly clay	CH	A-7-6	99-100	97-99	90-96	0. 1-0. 6	. 125	7. 0-8. 0	High.
Shale									
Clay	CH	A-7-5	100	100	93-99	0. 4 -1. 0	. 208	7. 8-8. 2	Very high.
Clay	CH	A-7-5	80-100	67-99	60-99	0. 3 -0. 7	. 183	7. 8-8. 3	Very high.
Clay	CH	A-7-5	80-100	67-99	60-99	0. 3 -0. 7	. 167	7. 8-8. 3	Very high.
Clay	CH	A-7-6	100	100	82	0. 4 -0. 8	. 167	7. 5-8. 2	Very high.
Clay	CH	A-7-6	98	98	85	0. 3 -0. 7	. 208	7. 5-8. 2	Very high.
Clay	CH	A-7-6	98	98	85	0. 3 -0. 7	. 175	7. 5-8. 2	Very high.
Clay	CH	A-7-6	98	98	85	0. 3 -0. 7	. 167	7. 5-8 2	Very high.
Clay	CH	A-7-6	80-100	67-99	70-99	0. 3 -0. 7	. 167	7. 5-8. 2	Very high.
Clay loam	CH or CL	A-6 or A-7	100	100	85	1. 0 -2. 0	. 117	8. 0-8. 3	High.
Clay loam	CH or CL	A-6 or A-7	100	100	85	1. 0 -2. 0	. 10	8. 0-8. 3	High.
Clay loam	CH	A-7	90	60-90	70-90	0. 9 -1. 8	. 10	8. 0-8. 3	High.
Loam or clay loam	SC or SM	A-4	100	100	50	1. 5 -2. 5	. 10	8. 0-8. 3	Low.
Clay loam	ML or CL	A-4	100	100	60	1. 5 -2. 5	. 10	8. 0-8. 3	Low.
Clay	CL	A-6 or A-7	100	100	90	1. 5 -2. 5	. 10	8. 0-8. 3	Low.

TABLE 3.—*Description of soils and their*

Soils[1]	Depth to contrasting materials	Soil description and hydrologic group	Depth from surface in typical profile
	Feet		*Inches*
Lewisville silty clay, 0 to 1 percent slopes	5+ to sand and gravel.	3 to 5 feet of well-drained, strongly calcareous silty clay in old alluvium; gravel at a depth of 4 to 15 feet; suitable for structures; good surface drainage but seeps and springs numerous. Hydrologic group B.	0 to 28 28 to 36 36 to 52
Lewisville silty clay, 1 to 3 percent slopes	5+ to sand and gravel.		
Lewisville silty clay, 3 to 5 percent slopes, eroded.	5+ to sand and gravel.		
Lewisville silty clay, 5 to 8 percent slopes, eroded.	5+ to sand and gravel.		
Lewisville soils, 5 to 8 percent slopes, severely eroded	5+ to sand and gravel.		
Payne clay loam, 0 to 2 percent slopes	7+ to sand and gravel.	5 to 15 inches of well-drained clay loam in calcareous old alluvium over blocky clay; about 75 percent of area underlain by stratified, water-bearing sand and gravel at a depth of 5 to 10 feet; slow to very slow surface and internal drainage. Hydrologic group D.	0 to 6 6 to 14 14 to 24 24 to 60
Pratt loamy fine sand, terrace, 0 to 3 percent slopes.	12+	4 to 12 feet of loamy fine sand over heavy clay on terraces; low mounds on surface; subject to blowing; rapid internal drainage. Hydrologic group A.	0 to 20 20 to 30 30 to 60
Stephen silty clay, 1 to 3 percent slopes	1.5 to chalk	8 to 18 inches of well-drained, strongly calcareous silty clay over chalk bedrock containing joints or fissures in about 50 percent of area; chalk fragments in many places; gray soils rich in calcium carbonate; chalky rubble parent material; moderately slow surface and internal drainage. Hydrologic group B.	0 to 20
Stephen-Eddy complex, 3 to 5 percent slopes, eroded (Stephen component).	1.0 to chalk		
Stephen-Eddy complex, 1 to 3 percent slopes, eroded (Stephen component).	1.0 to chalk		
Sumter clay, 5 to 12 percent slopes, severely eroded.	3+	3 to 5 feet of rolling to strongly sloping, strongly calcareous clay over clayey marl or clayey shale; rapid surface drainage and slow internal drainage. Hydrologic group D.	0 to 6 6 to 24 24 to 44
Trinity clay, frequently flooded	8+to sand and gravel.	8 to 30 feet of calcareous heavy clay on slowly drained flood plain; about 70 percent of area flooded frequently; slow surface and internal drainage. Hydrologic group D.	0 to 4 4 to 50
Trinity clay, loamy substratum	2.5+ to sand and gravel.	20 to 40 inches of calcareous heavy clay over loamy substratum on flood plains in areas flooded about once in 8 to 10 years; slow surface drainage and medium internal drainage. Hydrologic group B.	0 to 5 5 to 12 12 to 30 30 to 60
Trinity clay, occasionally flooded	8+ to sand and gravel.	8 to 30 feet of calcareous heavy clay on slowly drained flood plains; about 70 percent of area flooded occasionally; slow surface and internal drainage. Hydrologic group D.	0 to 4 4 to 50
Trinity clay, wet	8+ to sand and gravel.		
Wilson clay loam, 0 to 1 percent slopes	6+ to marl	4 to 15 inches of noncalcareous clay loam over dense clay; clayey marl parent material; slow to medium surface drainage and slow internal drainage. Hydrologic group D.	0 to 12 12 to 38 38 to 70
Wilson clay loam, 1 to 3 percent slopes	6+ to marl		
Wilson clay loam, 1 to 3 percent slopes, eroded.	6+ to marl		
Wilson clay loam, terrace, 0 to 1 percent slopes.	5+ to sand and gravel.	4 to 15 inches of slightly acid clay loam or fine sandy loam over dense clay; nearly level areas somewhat poorly drained; parent material is calcareous old alluvium; soil underlain at a depth of 5 to 8 feet by beds of stratified, water-bearing sand and gravel suitable for structures; slow surface drainage and very slow internal trainage. Hydrologic group D.	0 to 5 5 to 20 20 to 30 30 to 40 40 to 46
Wilson clay loam, terrace, 1 to 3 percent slopes.	5+ to sand and gravel.		

See footnote at end of table.

estimated physical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction (pH)	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
							Inches per inch of soil		
Silty clay	CL	A-6	100	100	85	1. 0 -2. 0	0. 133	8. 0-8. 3	Medium.
Silty clay	CL	A-6	100	100	85	1. 0 -2. 0	. 125	8. 0-8. 3	Medium.
Sandy clay	ML	A-4	100	98	60	2. 0 -4. 0	. 083	8. 0-8. 3	Low.
Clay loam	CL or CH	A-6	98	94	50	0. 5 -1. 0	. 125	6. 0-7. 3	Medium.
Clay loam	CL or CH	A-7	98	95	60	0. 4 -0. 7	. 146	6. 0-7. 0	Medium.
Clay	CH	A-7	99	98	80	0. 4 -0. 7	. 146	6. 0-7. 0	Medium.
Clay	CH	A-7	99	98	80	0. 4 -0. 7	. 146	5. 8-8. 0	Medium to high.
Loamy fine sand	SM	A-2	95	90	35	3. 0 -6. 0	. 058	5. 5-6. 6	Low.
Loamy fine sand	SM	A-2	95	90	35	3. 0 -6. 0	. 058	5. 5-6. 0	Low.
Loamy fine sand	SM	A-2	95	90	35	3. 0 -6. 0	. 058	6. 0-7. 0	Low.
Silty clay	CH or CL	A-6 or A-7	85-97	75-94	57-89	1. 0 -2. 0	. 125	7. 8-8. 3	Medium.
Clay	CH	A-7-6	100	100	89	0. 3 -0. 6	. 125	7. 8-8. 3	High.
Clay	CH	A-7-6	100	100	89	0. 9 -1. 8	. 104	7. 8-8. 3	High.
Clay	CH	A-7-6	80-100	67-89	70-99	0. 9 -1. 8	. 104	7. 8-8. 3	High.
Clay	CH	A-7-5	100	100	95	0. 4 -0. 8	. 208	7. 8-8. 2	High.
Clay	CH	A-7-6	100	100	95	0. 4 -0. 8	. 183	7. 8-8. 2	High.
Clay	CH	A-7	100	100	95	0. 5 -1. 0	. 208	7. 8-8. 2	High.
Clay	CH	A-7	90	100	95	0. 5 -1. 0	. 183	7. 8-8. 2	High.
Sandy clay	CL	A-4	100	90	70	2. 0 -3. 0	. 125	7. 8-8. 2	Medium.
Sandy loam	SM	A-2 or A-4	85	80	30-50	3. 0 -5. 0	. 083	7. 8-8. 2	Medium.
Clay	CH	A-7-5	100	100	95	0. 4 -0. 8	. 208	7. 8-8. 2	High.
Clay	CH	A-7-6	100	100	95	0. 4 -0. 8	. 183	7. 8-8. 2	High.
Clay loam	CL	A-6	100	100	80	0. 5 -0. 9	. 150	5. 6-6. 3	Medium.
Clay	CH	A-7-6	100	100	85	0. 2 -0. 6	. 158	6. 0-6. 7	High.
Clay	CH	A-7-6	100	100	85	0. 2 -0. 6	. 158	7. 5-8. 2	High.
Clay loam	CL	A-6	86	84	62	0. 4 -0. 8	. 142	6. 0-7. 5	Medium.
Clay	CL	A-7	88	86	68	0. 15-0. 6	. 150	6. 0-7. 5	Medium to high.
Clay	CH	A-7	88	86	68	0. 15-0. 6	. 167	6. 0-7. 5	High.
Clay	CH	A-7	90	88	70	0. 15-0. 6	. 167	6. 0-7. 5	High.
Clay	CH	A-7	94	90	72	0. 15-0. 6	. 167	7. 0-8. 2	High.

TABLE 3.—*Description of soils and their*

Soils [1]	Depth to contrasting materials	Soil description and hydrologic group	Depth from surface in typical profile
	Feet		*Inches*
Wilson fine sandy loam, 0 to 1 percent slopes.	6+ to marl	4 to 15 inches of noncalcareous fine sandy loam over dense clay; clayey marl parent material; slow to medium surface drainage and slow internal drainage. Hydrologic group D.	0 to 5 5 to 10 10 to 22 22 to 32 32 to 46 46 to 60
Wilson fine sandy loam, 1 to 3 percent slopes.	6+ to marl		

[1] Most soil complexes not listed. Their properties can be determined by referring to the soils in the complexes.

TABLE 4.—*Engineering*

Soil	Suitability as source of —	
	Topsoil	Sand and gravel
Austin silty clay, 1 to 3 percent slopes. Austin silty clay, 3 to 5 percent slopes, eroded. Austin silty clay, 5 to 8 percent slopes, eroded.	Good in surface layer	([1])
Bates fine sandy loam, 3 to 5 percent slopes, eroded. Bates-Lamar complex, 5 to 12 percent slopes, eroded.	Good in surface layer	Not suited
Brackett and Austin soils, 2 to 5 percent slopes, eroded.	Good in surface layer	([1])
Broken alluvial land.	Good	Not suited
Burleson clay, 0 to 1 percent slopes. Burleson clay, 1 to 3 percent slopes.	Poor	Fair
Burleson clay, depressional. Burleson clay, terrace, 0 to 1 percent slopes. Burleson clay, terrace, 1 to 3 percent slopes.	Poor	Fair
Crockett soils, 2 to 5 percent slopes, eroded. Crockett soils, 3 to 8 percent slopes, severely eroded.	Fair in surface layer	Not suited
Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes.	Good	Not suited
Eddy gravelly clay loam, 1 to 3 percent slopes. Eddy soils, 3 to 8 percent slopes, eroded. Eddy soils, 8 to 20 percent slopes.	Poor	([1])
Ellis and Houston clays, 3 to 5 percent slopes, eroded. Ellis and Houston clays, 5 to 12 percent slopes, severely eroded.	Poor	Not suited
Frio loam (0 to 1 percent slopes).	Good	Not suited
Frio silty clay, frequently flooded. Frio silty clay, occasionally flooded.	Good in surface layer	Not suited

See footnotes at end of table.

estimated physical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction (pH)	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
							Inches per inch of soil		
Fine sandy loam	ML or CL	A-4 or A-6	100	97	54	0.7 -1.0	0.125	5.5-6.5	Medium.
Fine sandy loam	ML or CL	A-4 or A-6	100	100	68	0.2 -0.6	.150	5.5-6.5	Medium.
Clay	CH	A-7-6	100	100	68	0.2 -0.6	.150	5.8-7.2	High.
Clay	CH	A-7-6	100	100	70	0.2 -0.6	.150	5.8-7.2	High.
Clay	CH	A-7-6	100	100	80	0.2 -0.6	.150	7.5-8.2	High.
Clay	CH	A-7-6	100	100	80	0.3 -0.7	.141	7.5-8.2	High.

interpretation of the soils

Soil features affecting suitability for—			Suitability for terraces and diversions
Dikes and levees	Farm ponds		
	Reservoir area	Embankments	
Adequate strength and stability; require wet compaction.	Excessive seepage; moderate permeability.	Adequate strength and stability; require wet compaction.	Well suited.
Well-graded soils; moderate permeability.	Moderate permeability; cemented sandstone at 6 feet or more.	Adequate strength and stability; require wet compaction.	Well suited.
Adequate strength and stability; require wet compaction.	Excessive seepage; moderate permeability.	Adequate strength and stability; require wet compaction.	Well suited.
Adequate strength and stability; requires wet compaction.	Excessive seepage; moderate permeability.	Adequate strength and stability; requires wet compaction.	Well suited.
Poorly graded soils;[2] very slow permeability.	Very slow permeability	Poorly graded soils; very slow permeability.	
Poorly graded soils;[2] very slow permeability.	Moderate permeability	Poorly graded soils; very slow permeability.	
Adequate strength; substratum very slowly permeable.	Good substratum; very slow permeability.	Adequate strength and stability; very slowly permeable substratum.	Well suited.
Rapid permeability; low clay content in top 20 to 30 inches.	High leakage	Rapid permeability; poorly graded.	Fairly well suited; soils 20 to 30 inches thick; clay not sufficient for stability.
Poorly graded soils;[2] chalky gravel	Chalk bedrock at 12 inches	Moderately rapid permeability; soils contain chalk fragments.	Moderately rapid permeability; chalk bedrock below 1 foot.
High shrink-swell ratio; crack when dry; poorly graded soils.	Very slow permeability	Poorly graded; crack when dry; very slow permeability.	Well suited; crack when dry; very slow permeability.
Rapid permeability	High leakage	Rapid permeability	Not needed.
Moderate permeability; require wet compaction.	Moderate permeability; stratified sand and gravel below 4 feet.	Adequate strength and stability; require wet compaction.	Not needed; some areas subject to frequent overflow.

TABLE 4.—*Engineering*

Soil	Suitability as source of —	
	Topsoil	Sand and gravel
Gullied land.	Poor	Not suited
Houston clay, 1 to 3 percent slopes. Houston clay, 3 to 5 percent slopes, eroded. Houston clay, 5 to 8 percent slopes, eroded.	Fair	Not suited
Houston and Ellis clays, 1 to 3 percent slopes.	Poor	Not suited
Houston Black clay, 0 to 1 percent slopes. Houston Black clay, 1 to 3 percent slopes.	Good	Not suited
Houston Black clay, terrace, 0 to 1 percent slopes. Houston Black clay, terrace, 1 to 3 percent slopes.	Good	Fair
Hunt clay, 0 to 1 percent slopes. Hunt clay, 1 to 3 percent slopes.	Good	Not suited
Lamar clay loam, 2 to 5 percent slopes, eroded. Lamar clay loam, 5 to 12 percent slopes, eroded.	Good in surface layer	Not suited
Lewisville association, 1 to 3 percent slopes. Lewisville association, 3 to 5 percent slopes, eroded. Lewisville association, 5 to 8 percent slopes, eroded.	Good	Suitable gravel at depth of 5 to 20 feet.
Lewisville silty clay, 0 to 1 percent slopes. Lewisville silty clay, 1 to 3 percent slopes. Lewisville silty clay, 3 to 5 percent slopes, eroded. Lewisville silty clay, 5 to 8 percent slopes, eroded. Lewisville soils, 5 to 8 percent slopes, severely eroded.	Good	Suitable gravel at depth of 5 to 20 feet.
Payne clay loam, 0 to 2 percent slopes.	Good in surface layer	Fair
Payne and Norge soils, 1 to 3 percent slopes.	Good in surface layer	Fair
Pratt loamy fine sand, terrace, 0 to 3 percent slopes.	Poor	Not suited
Stephen silty clay, 1 to 3 percent slopes. Stephen-Eddy complex, 1 to 3 percent slopes, eroded. Stephen-Eddy complex, 3 to 5 percent slopes, eroded.	Good in surface layer	[1]
Sumter clay, 5 to 12 percent slopes, severely eroded.	Poor	Not suited
Trinity clay, frequently flooded. Trinity clay, loamy substratum. Trinity clay, occasionally flooded. Trinity clay, wet.	Good	Suitable sand and gravel at depth of 6 to 8 feet in many places.

See footnotes at end of table.

interpretation of the soils—Continued

Soil features affecting suitability for—			Suitability for terraces and diversions
Dikes and levees	Farm ponds		
	Reservoir area	Embankments	
Slow permeability; cracks when dry.	Internal drainage slow; clayey shale and marl exposed.	Slow internal drainage; poorly graded.	Poorly suited because of gullies.
Poorly graded soils;[2] crack when dry.	Slow permeability; deep soils.	Poorly graded; crack when dry; slow permeability.	Well suited; slow permeability; crack when dry.
High shrink-swell ratio; crack when dry; poorly graded soils.[2]	Very slow permeability.	Poorly graded; crack when dry; very slow permeability.	Well suited; crack when dry; very slow permeability.
Poorly graded soils;[2] crack when dry.	Slow permeability; deep soils.	Poorly graded; crack when dry; slow permeability.	Well suited; slow permeability; crack when dry.
Poorly graded soils;[2] small amount of hard, rounded pebbles; crack when dry.	Slow permeability; stratified sand and gravel occur at a depth of 10 feet or more in about half the acreage.	Poorly graded; crack when dry.	
Poorly graded soils;[2] small amount of hard, rounded pebbles; crack when dry.	Slow permeability; deep soils.	Slow permeability; poorly graded; small amount of pebbles; crack when dry.	Well suited; slow permeability; crack when dry.
Moderate permeability.	Internal drainage slow; clayey shale and marl at a depth of 3 to 4 feet.	Adequate strength and stability; require wet compaction.	Fairly well to well suited.
Rapid permeability; low content of clay.	Rapid permeability; low clay content.	High leakage rate.	Fairly well suited; clay in top 20 to 30 inches; not sufficient for stability.
Moderate permeability; poorly graded to well-graded soils.[2]	Moderate permeability; water-bearing sand and gravel at a depth of 5 to 20 feet.	Moderate permeability; poorly to well graded; adequate strength.	Well suited; moderate permeability; well drained.
Poorly graded soil[2]	Moderate permeability; stratified sand and gravel at a depth of 7 feet or more.	Poorly graded.	Well suited.
Poorly graded soils[2]	Moderate permeability; stratified sand and gravel at a depth of 7 feet or more.	Poorly graded.	Well suited.
Rapid permeability; not suited.	Rapid permeability; not suited.	Rapid permeability; high leakage.	Not suited; too sandy.
Adequate strength and stability; require wet compaction.	Excessive seepage; moderate permeability.	Adequate strength and stability; require wet compaction.	Well suited.
Slow permeability; cracks when dry.	Internal drainage slow; clayey shale and marl at a depth of 3 to 4 feet.	Slow permeability; cracks when dry; poorly graded.	Well suited in areas not severely gullied; slow permeability; cracks when dry.
Slow permeability; crack when dry; poorly graded soils.[2]	Slow permeability in surface layer; sand and gravel at a depth of 5 to 8 feet in about half the acreage.	Slow permeability; crack when dry; poorly graded in top 5 to 8 feet.	Well suited.

TABLE 4.—*Engineering*

Soil	Suitability as source of — Topsoil	Suitability as source of — Sand and gravel
Wilson clay loam, 0 to 1 percent slopes. Wilson clay loam, 1 to 3 percent slopes. Wilson clay loam, 1 to 3 percent slopes, eroded.	Fair in surface layer	Not suited
Wilson clay loam, terrace, 0 to 1 percent. Wilson clay loam, terrace, 1 to 3 percent.	Good in surface layer	Suitable water-bearing sand and gravel at depth of 5 to 8 feet.
Wilson fine sandy loam, 0 to 1 percent slopes. Wilson fine sandy loam, 1 to 3 percent slopes.	Fair in surface layer	Not suited

[1] Good source of marl or chalk.
[2] In engineering, a poorly graded soil is one made up of particles nearly the same size. Because there is little difference in size of particles in a poorly graded soil, density can be increased only slightly by compaction.

TABLE 5.—*Engineering test data for soil*

Soil and location	Parent material	Texas report No.	Depth	Horizon	Shrinkage Limit	Shrinkage Ratio	Field moisture equivalent
			Inches		*Percent*		*Percent*
Austin clay:							
2.5 miles NW. of Waxahachie. (Modal)	Austin chalk.	60–131–R	0–5	Ap	18	2. 03	53
		60–132–R	38–54	C	16	1. 92	40
6 miles N. of Waxahachie. (Light)	Austin chalk.	60–133–R	0–5	Ap	15	1. 87	34
		60–134–R	24–34	C	18	1. 74	26
9 miles S. of Waxahachie. (Heavy)	Austin chalk.	60–150–R	0–6	Ap	13	1. 89	49
		60–151–R	14–26	AC	12	1. 93	39
		60–152–R	26–44	C	15	1. 88	34
Burleson clay:							
2.5 miles W. of Forreston. (Modal)	Old alluvium (marine terrace).	60–153–R	0–6	Ap	13	1. 93	37
		60–154–R	22–48	A13	10	1. 97	41
		60–155–R	60–84	C	10	2. 01	44
1.5 miles SE. of Five Points Store. (Light)	Old alluvium (marine terrace).	60–156–R	0–5	Ap	11	1. 96	35
		60–157–R	20–30	A13	12	2. 00	38
		60–158–R	43–60	C	10	2. 03	40
2.2 miles SE. of Avalon. (Heavy)	Old alluvium (marine terrace).	60–159–R	0–5	Ap	8	2. 02	42
		60–160–R	30–40	A13	9	2. 02	44
		60–161–R	66–84+	C	9	2. 03	45
Ellis clay:							
15 miles SW. of Waxahachie. (Modal)	Eagle Ford shale.	60–125–R	0–2	A1	10	2. 00	52
		60–126–R	23–30	C	11	1. 96	53
15 miles W. of Waxahachie. (Light)	Eagle Ford shale.	60–127–R	0–4	Ap	12	1. 94	45
		60–128–R	24–34	C	15	1. 84	40
17 miles NW. of Waxahachie. (Heavy)	Eagle Ford shale.	60–129–R	0–3	Ap	12	1. 96	37
		60–130–R	20–32	C	15	1. 89	35

See footnotes at end of table.

interpretation of the soils—Continued

Soil features affecting suitability for—			Suitability for terraces and diversions
Dikes and levees	Farm ponds		
	Reservoir area	Embankments	
Slow permeability; substratum poorly graded.[2]	Very slow permeability; deep soils underlain by marl.	Very slow permeability; poorly graded; medium shrink-swell potential.	Well suited; very slow permeability; poorly graded.
Adequate strength and stability; very slow permeability.	Very slow permeability; water-bearing sand and gravel at a depth of 5 to 8 feet.	Moderately well graded; very slow permeability; adequate strength.	Well suited; very slow permeability.
Surface layer fairly well graded; substratum poorly graded.[2]	Very slow permeability; deep soil underlain by marl.	Very slow permeability; poorly graded; medium shrink-swell potential.	Well suited; very slowly permeable; poorly graded.

samples from 15 soil profiles in Ellis County [1]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—					AASHO [3]	Unified [4]
2 in.	¾ 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.				
-------	-------	-------	100	99	98	97	62	50	79	44	A-7-5(20)	MH-CH.
-------	100	97	94	92	89	87	58	47	65	40	A-7-6(20)	CH.
-------	-------	100	98	93	79	74	47	33	43	19	A-7-6(12)	CL.
100	94	85	75	69	57	55	39	17	39	16	A-6(7)	CL.
-------	-------	-------	-------	100	96	92	57	45	64	28	A-7-5(19)	MH.
-------	-------	100	99	97	92	89	64	48	56	29	A-7-6(19)	CH.
100	97	88	80	74	66	63	53	35	48	24	A-7-6(13)	CL.
-------	-------	-------	100	99	91	88	49	39	52	28	A-7-6(18)	CH.
-------	-------	-------	-------	100	92	90	55	48	60	34	A-7-6(20)	CH.
100	98	95	92	89	83	81	55	48	70	43	A-7-6(20)	CH.
-------	-------	-------	100	99	82	75	50	42	50	27	A-7-6(17)	CL.
-------	100	99	99	99	84	79	54	48	59	36	A-7-6(20)	CH.
-------	100	99	96	95	84	81	56	49	63	40	A-7-6(20)	CH.
-------	-------	-------	-------	100	97	93	59	50	65	39	A-7-6(20)	CH.
-------	-------	-------	-------	100	96	94	63	56	71	45	A-7-6(20)	CH.
-------	-------	-------	100	97	94	92	62	55	78	51	A-7-6(20)	CH.
-------	-------	100	98	96	94	93	83	62	92	56	A-7-5(20)	CH.
-------	-------	-------	-------	100	98	94	76	62	99	61	A-7-5(20)	CH.
-------	-------	100	99	98	96	95	88	72	83	49	A-7-5(20)	CH.
-------	-------	100	99	95	90	89	77	64	73	42	A-7-5(20)	CH.
-------	100	99	97	93	90	89	71	60	63	35	A-7-6(20)	CH.
-------	-------	100	99	97	96	95	74	65	67	42	A-7-6(20)	CH.

TABLE 5.—*Engineering test data for soil samples*

Soil and location	Parent material	Texas report No.	Depth	Horizon	Shrinkage		Field moisture equivalent
					Limit	Ratio	
			Inches		*Percent*		*Percent*
Payne fine sandy loam:							
2 miles W. of Maypearl. (Modal)	Mixed alluvium (high terrace).	60-141-R	0-4	Ap	17	1.71	17
		60-142-R	17-30	B2	12	1.96	30
		60-143-R	52-66	C1	13	1.94	29
20 miles W. of Waxahachie. (Lighter B horizon and deeper)	Mixed alluvium (high terrace).	60-147-R	0-5	Ap	17	1.79	21
		60-148-R	12-40	B2	12	1.95	28
		60-149-R	50-80	C	11	2.13	29
21 miles W. of Waxahachie. (No sand and gravel in C horizon)	Mixed alluvium (high terrace).	60-144-R	0-7	Ap	17	1.75	23
		60-145-R	20-30	B2	12	1.92	26
		60-146-R	50-80+	C	15	1.82	18
Wilson clay loam:							
10 miles SW. of Ennis. (Modal)	Taylor marl.	60-138-R	0-5	Ap	16	1.81	27
		60-139-R	16-38	B2	11	1.94	35
		60-140-R	44-70+	C	10	2.00	32
6 miles S. of Ennis. (Light)	Taylor marl.	60-162-R	0-6	Ap	17	1.78	23
		60-163-R	16-34	B2	11	1.99	30
		60-164-R	46-70+	C1	11	1.99	33
4 miles NE. of Ennis. (Heavy)	Taylor marl.	60-135-R	0-6	Ap	16	1.78	23
		60-136-R	14-34	B2	12	1.94	31
		60-137-R	46-70+	C	12	1.97	30

[1] Tests performed by the Texas Highway Department according to standard procedures of the American Association of State Highway Officials (AASHO).

[2] Mechanical analyses according to the American Association of State Highway Officials Designation: T 88. Results by this procedure frequently differ 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 and the 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.

Gully control.—The stabilization of gullies usually requires mechanical structures as well as plant cover. In Ellis County, the Crockett, Ellis, Houston, Lewisville, and Sumter soils are most susceptible to deep gully erosion. Areas of these soils are severely eroded, and in these areas it is difficult to build a drainageway that will safely carry diverted water. A gully can be stabilized most successfully by doing four things: (1) Building an earth embankment across the gully; (2) installing a low-head principal spillway that has a drop or hooded inlet; (3) building an emergency spillway on stable grade; and (4) sodding or seeding the embankment to perennial grass. Severely eroded areas above the structure should be smoothed enough to allow safe operation of farm equipment, and then they should be planted to perennial grass.

Engineering classification systems

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (*1*). In this system soils are classified in seven principal groups. The groups range from A-1, containing gravelly soils of high bearing capacity, to A-7, containing clay soils of low strength when wet. In each main group the relative engineering value of the soil material may be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. A group index can be shown in parentheses following the soil group symbol. The group index for soils sampled in Ellis County is shown in table 5.

Some engineers prefer to use the Unified system of soil classification, which was established by the Corps of Engineers, U.S. Army (*11*). In this system soil material is divided into 15 classes, 8 for coarse-grained material, 6 for fine-grained material, and 1 for highly organic material. This system is based on the texture and plasticity of soils and their performance as construction material. The organic soils have undesirable construction characteristics. The Unified classification of each soil in the county is given in table 3.

Engineering properties of soils

In table 3, beginning on page 42, each soil in the county is briefly described, its hydrologic group is designated, and its physical properties significant to engineering are estimated. The Unified and AASHO classifications for *from 15 soil profiles in Ellis County* [1]—Continued

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—					AASHO [3]	Unified [4]
2 in.	¾ 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.				
-------	-------	-------	100	99	28	23	11	9	19	3	A-2-4(0)	SM.
-------	-------	-------	100	99	70	66	43	40	45	26	A-7-6(14)	CL.
-------	100	96	94	93	66	63	38	35	44	27	A-7-6(14)	CL.
-------	-------	-------	100	99	50	39	21	19	24	8	A-4(3)	SC.
-------	-------	-------	100	99	70	63	43	40	41	23	A-7-6(12)	CL.
-------	-------	-------	100	99	77	73	55	44	46	28	A-7-6(16)	CL.
-------	-------	-------	-------	100	47	41	23	20	26	6	A-4(2)	SM-SC.
-------	-------	-------	-------	100	67	61	38	35	37	20	A-6(10)	CL.
-------	-------	-------	-------	100	50	48	27	26	30	15	A-6(5)	SC.
-------	-------	-------	-------	100	78	69	27	25	35	18	A-6(11)	CL.
-------	-------	-------	100	99	85	73	42	38	49	28	A-7-6(17)	CL.
-------	-------	100	97	93	79	74	43	37	50	32	A-7-6(18)	CL.
-------	-------	-------	-------	100	80	70	19	16	24	7	A-4(8)	ML-CL.
-------	-------	-------	-------	100	88	80	40	36	46	29	A-7-6(17)	CL.
-------	-------	-------	100	99	88	83	44	39	53	35	A-7-6(19)	CH.
-------	-------	-------	100	99	81	69	24	21	28	11	A-6(8)	CL.
-------	-------	-------	-------	100	85	78	40	36	50	32	A-7-6(18)	CL.
-------	-------	-------	100	98	80	76	60	45	54	35	A-7-6(19)	CH.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation: M 145–49.

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3–357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

the Houston Black clay; Houston Black clay, terrace; Houston clay; Lewisville silty clay; Lewisville association; and Trinity soils were based on test data furnished by the Soil Conservation Service, Soil Mechanics Laboratory, Lincoln, Nebraska, for flood prevention sites on Chambers Creek in Ellis County.

Permeability, as shown in table 3, was estimated for the soil material as it occurs without compaction.

The available water-holding capacity in inches per inch of depth is an estimate of the capillary water when the soil is wet to field capacity. This amount of water wets air-dry soil material to a depth of 1 inch and does not percolate deeper.

The shrink-swell potential indicates the volume change of the soil material that can be expected with change in moisture content. In general, soil material classified as CH and A–7 have *high* shrink-swell potential, although the A–C horizon of Houston Black clay and other soil material is rated *very high.* The shrink-swell potential is low in clean sands and gravels (single-grain structure), in soils having small amounts of nonplastic to slightly plastic fines, and in most other nonplastic to slightly plastic soil material.

Hydrologic groups of soils.—Hydrologists frequently use a hydrologic grouping of soils along with other data to compute the amount of runoff from a particular watershed after a storm of some given or actual intensity and duration. Knowledge of soil profile characteristics has been used in placing the soils of the county into four hydrologic groups. The soils were grouped according to the system explained in the Soil Conservation Service Engineering Handbook, Supplement A, section 4. The groups range from tight clays (highest runoff potential) to open sands (lowest runoff potential). The groupings express the relative intake of water at the end of storms during which soils have been wet and have swelled. Also needed to compute the amount of runoff from a watershed are data on land use and treatment.

The soils in group A are deep sands with very little silt and clay, and deep, rapidly permeable loess. In group B are (1) sandy soils less deep than the soils in group A; (2) clay soils that contain appreciable amounts of silt; and (3) highly aggregated clays. The group has above-average infiltration after thorough wetting. In group C are shallow soils and soils that contain much clay and a large amount of colloids, though less than those in group D. Infiltration after presaturation is below average. Group D is made up mostly of clays that have a high swelling percentage, but the group includes some shallow soils that have an almost impermeable subhorizon near the surface. The soils in group D absorb less water than the soils in any other group, and runoff is very rapid.

Engineering interpretation of soils

In table 4, beginning on page 48, are given suitability ratings for the soils in the county as sources of topsoil and of sand and gravel, and features of the soils that affect conservation structures.

Waterways can be established on all soils that are deeper than 18 inches to bedrock. Waterways on slowly permeable soils require intensive management to maintain the adequate cover that will control erosion. If they are carefully placed and compacted, practically all the soils can be used in embankments for impounding water except the Austin, Pratt, Dougherty, Stidham, Eddy, Lewisville, and Stephen soils. Some soils need to be sampled and tested before engineering works are started. The soils west of the Austin chalk outcrop contain varying amounts of halloysite (*3*). This particularly unstable clay mineral occurs on gentle slopes of Ellis and Houston clays, the Houston and Ellis clays, and similar soils. The reservoir area of farm ponds generally needs special practices to reduce excessive seepage in the Austin, Eddy, Frio, Lewisville, Stephen, and similar soils.

Winter grading and frost action are not problems in Ellis County, but saturated clays dry slowly in winter. Subfreezing temperatures occur for fairly short periods but have little effect on winter grading.

Engineering test data

In table 5 (see p. 52) are the results of tests of 15 samples from 5 principal soil series in Ellis County. The tests were made according to standard AASHO procedures so that the soils could be evaluated for engineering purposes.

The results of a mechanical analysis, obtained by the combined sieve and hydrometer method, can be used to determine the relative proportions of different sized particles that make up the soil sample. The clay content obtained by the hydrometer method, which is generally used by engineers, should not be used to determine soil textural classes.

The values of the liquid limit and the plastic limit indicate the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a completely dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content, based on the ovendry weight of the soil, at which the material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The numerical difference between the liquid limit and the plastic limit is called the plasticity index. It indicates the range of moisture content within which soil material is in a plastic condition.

Soils in urban development

Soil properties and profile characteristics need to be considered in planning structures for urban development. Soils in the county that have a high shrink-swell potential are in the Burleson, Ellis, Houston, Houston Black, Hunt, Sumter, and Trinity series. (See table 3.) Soils that have a low or medium shrink-swell potential do not require a special design for foundations of one-story buildings, but detailed investigation should be made for buildings that have foundation loadings or a height greater than that of one-story houses.

Flooding is likely on the Burleson soils in depressions and on the Frio and Trinity soils. Planning should include provisions for protecting buildings from flood. Any steel or cast iron pipe should have a protective coating if placed in saline soils or slickspots, which are common in the Crockett, Ellis, Houston, and Wilson soils. Small saline areas are indicated on the soil map by the symbol theta as indicated on the legend; large areas are shown by the symbol Sc.

Water for domestic use is often tapped from the shallow strata under the Burleson, Pratt, Lewisville, Paine, Houston Black, clay, terrace, and Wilson clay loam, terrace, soils. On these soils a septic tank near a domestic water supply may pollute the ground water. An experienced sanitation engineer should be consulted before a septic tank is installed. On the Austin, Eddy, and Stephen soils, seeps in wet weather make special precautions necessary in locating septic tanks. All septic tanks should be located downslope from domestic water supplies and residences.

Absorption fields for septic tanks require special consideration on the Burleson, Crockett, Ellis, Houston, Houston Black, Hunt, Wilson, and other soils that have very slow internal drainage. On these soils the size of the gravel bedding and the length of the absorptive field should be increased.

Gravel pits and Clay pits account for about 0.1 percent of the county. These areas should be kept sanitary and free from refuse and stagnant water. Any condition that endangers human life should be corrected. If it is economically feasible, abandoned gravel pits and clay pits should be smoothed and seeded to forage or food crops.

Formation and Classification of Soils

This section consists of three main parts. The first part tells how the soils of Ellis County were formed. In the second part the soil series are placed in great soil groups according to important differentiating characteristics. The third part provides, for each series, a technical description in which the profile of a soil representative of the series is described by horizons.

Factors of Soil Formation

Soil is the product of the interaction of several factors in nature. The main factors are climate; relief, or lay of land; parent material; living organisms; and time. The kind of soil that develops at any point on the earth is determined by these interacting factors.

Climate and living organisms are active forces in soil formation. They act slowly on the parent material and change its form. As this weathering of the rocks proceeds and earthy material accumulates, distinct horizons are formed in this material. Relief modifies or conditions the effects of climate and vegetation through its effect on drainage. Drainage influences the weathering of the parent material and the kind of soil profile that develops. In some places, however, a profile develops that is almost entirely the result of the effects of the parent material. Time is needed to change this parent material into a soil.

Because the interrelations among the factors of soil formation are complex, it is difficult to tell the effects of any one factor. Therefore, when the effects of each factor are discussed, it should be remembered that the developed soil profile is a result of the interaction of all these factors.

Climate

The subhumid, continental climate of Ellis County contributes to the formation of soils in several ways. In most years rainfall is heavy enough to cause some leaching, and the shallow soils are leached more often than are the deeper soils. Because rainfall is well distributed, the soils are alternately wet and dry. When the heavy clays dry, they crack severely and the cracks fill with water when it rains. Thus, these soils are wet to lower depths than other soils. After they become wet, they swell enough to close the cracks, and water is absorbed from the surface in the same way as in other soils.

Winters are not severe enough in Ellis County for the freezing of soil to be a factor in soil formation. The temperature of the soil remains high enough for soil micro-organisms to be somewhat active at all times. Although the surface layer may freeze, it freezes only to a depth of a few inches and stays frozen for only a few days at a time.

Living organisms

The living organisms on and in the soils are plants and animals of various sizes. The plants that live in the soil range from trees to bacteria, fungi, or other microscopic plants. In the blackland, tall prairie grasses had more influence than other plants on soil development. These tall grasses provided litter that protected the surface and added organic matter to the soil. Their roots reached deep into the soil and fed on minerals at lower depths. When the grasses died, large amounts of these minerals were left on the surface. Lime, or other minerals, and organic matter were distributed through the soil profile as these plants died and decomposed and were replaced by new plants. When the roots of plants decomposed, they left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms feed on the decomposed roots. The borings of earthworms also help to channel water and air through the soil profile.

The processes of soil development were well balanced under natural conditions before man began using the soil. Vegetation covered the soil, and the soil-forming processes were active. But these processes have been disturbed where man has misused the soil by clean tilling and by permitting overgrazing. The native vegetation has been destroyed, and accelerated erosion has removed much of the surface layer on many soils. On many fields used mainly for row crops, the activity of micro-organisms and earthworms has been reduced greatly in the surface layer.

Parent material

The soils in the blackland of Ellis County have developed from four main kinds of material. These are shale of the Eagle Ford formation, chalk of the Austin formation, marl of the Taylor formation (*6*), and alluvium deposited in various parts of the county. (See figure 2, p. 3.)

Soils developed over shale in the western part of the county. Eagle Ford shale crops out in many places adjacent to the Austin chalk escarpment. Along this escarpment the soils are shallow and shaly, and the influence of shale is pronounced. Influence is more pronounced in moderately shallow Ellis clay and Houston clay than it is in Houston Black clay that is farther from the outcrops of shale. In most places in the western part of the county, the shale is overlain by layers of clayey marl and of earthy marine sediments. In these places the soils are more granular than are those soils closer to the outcrops of shale.

Chalk of the Austin formation has greatly affected the development of the Austin, Brackett, Eddy, Stephen, and other soils. In some places chalk has also influenced the development of the Frio and Houston Black soils. In general, soils developed over the chalk are granular, crumbly, and strongly calcareous. The deeper soils are dark in color and are self-mulching. Houston Black clay and other clayey soils crack when they dry. These soils commonly grade to chalky rubble or chalky marl over chalky bedrock.

The Austin formation crops out in the west-central part of the county. This area is well dissected with natural drains and has more varied relief than any other part of the county. The Eddy, the Stephen, and other of the thinner soils occur on the ridges where the chalk is near the surface.

The Taylor formation is in the eastern part of the county in an area that is mainly gently rolling and has good surface drainage. It consists mainly of clayey marl. Many local areas contain earthy marine sediments that have influenced the development of the Lamar and other more granular soils. Some soils that developed over the Taylor marl contain a claypan. Examples are the Crockett and Wilson soils. Clayey soils that developed over the Taylor marl are in the Burleson, Houston, Houston Black, Hunt, and Sumter series.

The recent alluvium deposited in the county is mainly from the blackland prairie and has influenced the development of Trinity soils and other calcareous clays. In most places, the Frio, Lewisville, and other crumbly clays developed in sediments washed from the Austin formation. Several areas in the county have received from undetermined sources sediments that are in beds of stratified sand and gravel at a depth lower than that of recent alluvium. These sediments have influenced the development of the Burleson and Houston Black soils on terraces, and of the Wilson, the Payne, and the Lewisville soils. Where sandy sediments occur on the surface, Pratt loamy fine sand, terrace, has developed.

Relief

Relief, or lay of the land, accounts for the variations in elevation and affects soil formation within a local area. Because of its influence on runoff and drainage, relief may favor some processes of horizon development and may inhibit others. Therefore, unlike profiles have developed from the same kind of parent materials in different positions within a local area. In sloping areas soils are generally well drained. In small valleys, depressions, and other concave areas, soils receive extra water that runs in from the adjacent higher lying areas and are poorly drained.

In this area slopes of more than 1 or 2 percent are unfavorable for soil development because runoff is excessive and water needed by growing plants is lost. Moreover, this runoff causes erosion if the soil is bare. Shallow soils developed in Ellis County on the steeper slopes. In areas that lose large amounts of water in runoff, less water is stored in the soil. Soils with stronger relief, therefore, are more droughty than similar soils having less relief. On the more droughty soils the adapted vegetation is made up of smaller plants that are tolerant of drought.

Relief affects the soil temperature. Slopes facing south and west have more hours of sunlight and absorb more direct sun rays than slopes facing north and east. Slopes facing south and west are warmer and drier than those facing north and east. For these reasons, the adapted vegetation differs on these different slopes.

Time

The length of time that climate, living organisms, parent material, and relief or drainage have had to work undisturbed determines to a great extent the kind of soil that develops. Young soils have had little development. Their soil material has not been in place long enough for well-defined, genetically related horizons to form.

The Trinity and Frio soils on the flood plain of streams are examples of young soils. On steep slopes geologic erosion has removed soil almost as fast as it has formed. Older soils have been in place a long time and have approached equilibrium with the environment. These older soils are considered mature and have developed definite horizons. They are generally well drained and nearly level to gently sloping. Wilson soils are soils of this kind in Ellis County.

Classification of the Soils

Soils are placed in narrow classes or groups so that their behavior within farms, ranches, or counties can be studied. They are placed in broad classes so that continents or other large areas can be studied and compared. In the comprehensive system of soil classification followed in the United States the soils are placed in six categories, one above the other. Beginning at the top, the six categories are order, suborder, great soil group, family, series, and type.

In the highest category the soils are grouped into three orders whereas thousands of soil types are recognized in the lowest category. The suborder and family categories have never been fully developed and thus have been little used. Attention has been given largely to the classification of soils into soil types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups and orders. Soil series, soil type, and soil phase are defined in the Glossary in the back of this report. Soil types are divided into phases so that finer distinctions significant to use and management can be made.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders (*8*). The zonal order is made up of soils with evident, genetically related horizons that reflect the predominant influence of climate and living organisms in their formation. In the intrazonal order are soils with evident, genetically related horizons that reflect the influence of topography or parent materials over the effects of climate and living organisms. The azonal order consists of soils that lack distinct, genetically related horizons, commonly because of their youth, resistant parent material, or steep topography.

The classification of the soils in Ellis County by order, great soil group, and series is in the following list.

ZONAL:
- Reddish Prairie soils—
  - Bates.
  - Norge.
  - Payne.
  - Crockett.
- Red-Yellow Podzolic soils—
  - Dougherty.
  - Stidham.
- Chestnut soils—
  - Pratt.

INTRAZONAL:
- Grumusols—
  - Burleson.
  - Houston.
  - Houston Black.
  - Hunt.
- Planosols—
  - Wilson.

INTRAZONAL—Continued
- Rendzina soils—
  - Austin.
  - Lewisville.
- Brunizem soils—
  - Stephen.

AZONAL:
- Alluvial soils—
  - Frio.
  - Trinity.
- Lithosols—
  - Brackett.
  - Eddy.
  - Ellis.
- Regosols—
  - Lamar.
  - Sumter.

Technical Descriptions of Soils

This subsection was prepared for those who need more technical information about the soils in the county than is given elsewhere in the report. Described in alphabetic order are the soil series in the county. The procedure is to name characteristics common in the county to the soils in the series and to describe, by horizons, a profile at a stated location. The profile is representative of the series. A profile description is a record of what the soil scientist saw when he dug into the ground and studied the soil. After the profile is described, variations from this profile are given, and generally the soil series is compared to other soil series in the county. Soil descriptions that are probably easier for the general reader to understand are given in the section "Descriptions of the Soils." They contain some interpretations and other information that are not in this subsection.

Austin series

Soils in the Austin series are moderately deep, well-drained, grayish-brown silty clays that have strong, subangular blocky and granular structure. They developed under tall native grasses in thick beds of white chalk or weakly indurated chalky marl of the Austin formation. These soils are gently sloping to sloping Rendzinas and are well dissected by natural drains. Eroded soils are commonly light gray. In places these soils are somewhat gravelly or contain fragments of white chalk.

Profile of Austin silty clay (100 feet north of road in a cultivated field 4 miles west and 0.5 mile north of the junction of U.S. Highway No. 77 and farm road 66 in Waxahachie)—

A1p—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; strong, fine, subangular blocky to granular structure: firm but crumbly when moist, sticky when wet; many fine pores; many, fine, fibrous roots; many concretions of calcium carbonate 1 to 2 millimeters across; strongly calcareous; abrupt boundary.

A12—6 to 16 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, platy structure that breaks to strong, subangular and granular structure; firm but crumbly when moist, sticky when wet; few, fine, fibrous roots; many concretions of calcium carbonate 2 to 4 millimeters across; strongly calcareous; gradual, smooth boundary.

A13—16 to 22 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 4/3) when moist; strong, very fine, subangular blocky to medium, granular structure; firm when moist but more crumbly than horizon A12, very sticky when wet; many medium pores; many concretions of calcium carbonate 3 to 5 millimeters across; few fragments of weathered chalk; strongly calcareous; gradual, smooth boundary.

AC—22 to 34 inches, very pale brown (10YR 7/4) silty clay, yellowish brown (10YR 5/4) when moist; strong, fine to medium, granular structure; firm but crumbly when moist, very sticky when wet; crumbles on handling; some large, loose lime splotches 5 to 10 millimeters across; few fragments of weathered chalk; strongly calcareous; gradual, smooth boundary.

C—34 to 42 inches +, very pale brown (10YR 8/4) silty clay, very pale brown (10YR 7/4) when moist; 50 percent of volume is partly weathered soft chalk; strong, fine, granular structure; very friable when moist, sticky when wet; many, weathered, chalky fragments; strongly calcareous; abrupt boundary; white chalky bedrock below 42 inches.

When dry, the surface layer ranges from grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2). It is usually about two units of value darker when moist. Thickness to chalky bedrock ranges from 20 to about 50 inches. Austin soils are thickest in small valleys and along foot slopes. The content of lime in the surface layer appears fairly high in the lighter colored soils, which occur on ridges in most places. Reaction of all horizons ranges from about pH 8.0 to 8.3.

These soils are gently sloping to sloping. Of the total acreage, about 68 percent is gently sloping, about 26 percent is moderately sloping, and about 10 percent is sloping. The thick, friable, granular soils are well drained; the thinner, lighter colored soils are droughty.

Austin soils are lighter colored, less clayey, and thinner than the Houston Black soils and are more friable and more granular. They are also more sloping, higher in lime, and contain more chalk fragments. They are less clayey and lighter colored throughout than Houston Black soils. Austin soils developed in chalk, but Lewisville soils developed in thick deposits of alluvium.

The Austin soils occur mainly in the west-central part of the county above the Austin chalk formation. They make up about 10 percent of the county.

Bates series

Soils in the Bates series are dark grayish-brown fine sandy loams in the Reddish Prairie great soil group. The upper part of their subsoil is yellowish-brown, friable to firm sandy clay loam. These soils are medium acid to strongly acid and are moderately sloping to moderately steep. The parent material consists of very pale brown sandy clay loam and weakly cemented sandstone. The native vegetation is tall grasses and scrubby hardwoods, in which post oak is dominant. These soils contain well-defined draws, which are wooded.

Profile of Bates fine sandy loam (in a pasture 0.3 mile east and 0.8 mile south of Bristol on left side of road about 20 feet from the fence)—

A1p—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, blocky and granular structure; hard when dry, friable when moist, slightly sticky when wet; many fine pores; many fine roots; noncalcareous; pH 7.0; abrupt boundary.

A12—6 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) when moist; many dark yellowish-brown (10YR 4/4) mottles, dark brown (10YR 3/4) when moist; weak, blocky and granular structure; compacted by tillage; very hard when dry, friable when moist, sticky when wet; many fine, fibrous roots; pH 6.4; gradual boundary.

B21—9 to 24 inches, yellowish-brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) when moist; dark-brown (10YR 3/4) mottles, dark yellowish brown (10YR 4/3) when moist; moderate, medium, blocky structure; slowly permeable; very hard when dry, slightly firm when moist, sticky when wet; pH 5.0; gradual boundary.

B22—24 to 36 inches, yellowish-brown (10YR 5/6) sandy clay loam, dark yellowish brown (10YR 4/6) when moist; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky when wet; pH 5.3; gradual boundary.

C1—36 to 50 inches, yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) when moist; moderate, fine, subangular blocky to granular structure; hard when dry, very friable when moist, slightly sticky when wet; pH 5.5; gradual boundary.

C—50 to 60 inches +, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) when moist; weak, granular structure; hard when dry, very friable when moist, slightly sticky when wet; pH 5.5.

When dry, the surface layer ranges from grayish brown (10YR 5/2) to brown (10YR 5/3). The A horizon generally ranges from 4 to 12 inches in thickness, but in places it is as thick as 24 inches. It is loam to fine sandy loam and has a pH of 6.0 to 7.2.

The subsoil of Bates soils is slightly firm to friable in the upper part and is less mottled and not so tight as the subsoil in Crockett soils. Generally, Bates soils are more sloping than the Crockett soils. They are not so strongly calcareous as Lewisville soils and have a less friable subsoil.

These soils are moderately sloping to moderately steep and are dissected by well-defined natural draws. Erosion is commonly active in the central channel of these draws. About 70 percent of the acreage in this county is on slopes ranging from 5 to 12 percent.

Bates soils occur in the northeastern part of the county near Bristol. Bates fine sandy loam and the Bates-Lamar complex were mapped. They are fairly rough and make up about 350 acres.

Brackett series

In the Brackett series are shallow, well-drained, light brownish-gray Lithosols that have weak, granular and subangular blocky structure. They developed under mid and tall native grasses in chalky marl underlain by the Austin chalk. Because they occur mainly on narrow, gently sloping to sloping ridges, these soils are generally eroded. In eroded areas these soils are fairly light colored and in most places contain many chalk fragments or pebbles.

Profile of Brackett silty clay (on graveled road 0.2 mile east of intersection with farm road 1493 about 5 miles southwest of Waxahachie)—

A1p—0 to 7 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (10YR 4/2) when moist; weak granular to moderate, very fine, subangular blocky structure; firm but very crumbly when moist, slightly plastic when wet; many medium pores; many hard concretions of calcium carbonate; few small fragments of hard chalk on surface; strongly calcareous; pH 8.3; gradual boundary.

AC—7 to 19 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; strong, medium, granular and fine, subangular blocky structure; firm, but very crumbly when moist, sticky when wet; many medium pores; many concretions of calcium carbonate; strongly calcareous; pH 8.3; gradual, smooth boundary.

C—19 to 30 inches +, very pale brown (10YR 8/3), thin, compact, platy marl, very pale brown (10YR 7/3) when moist; common yellowish-brown splotches; slightly hard when dry; strongly calcareous; pH 8.3; grades to thin, platy, compact chalky marl or shale that is hard when moist.

When dry, the surface layer commonly ranges from light brownish gray (10YR 6/2) to brown (10YR 5/3), but it is light gray to very pale brown in a few severely eroded areas. The thin soils contain many chalk fragments. Depth to the compact, platy chalky marl ranges from 15 to 25 inches. Depth to hard chalk bedrock is 50 inches or more. The content of lime in the surface layer is very high. Reaction of all horizons is about pH 8.3.

Brackett soils have slopes of about 2 to 5 percent. They are mainly on the point of narrow ridges but are also on part of the gently sloping ridgetops and part of the side slopes. Erosion is dominantly sheet erosion.

Brackett soils are lighter colored, more limy, and more droughty than the Austin soils. They are lighter colored, deeper, and more droughty than the Stephen soils. They are deeper than the Eddy soils and not so gravelly.

These soils are only in the west-central part of the county, where they are underlain by the Austin formation. They occur in many fairly small areas and make up only 0.17 percent of the county.

Burleson series

In the Burleson series are deep, very dark gray, crusty Grumusols that developed mainly in beds of calcareous, clayey old alluvium. They are nearly level to gently sloping. These soils developed under tall native grasses and in patches of hardwoods. They are dominantly slightly acid to neutral but in places are alkaline. In most places they are underlain by beds of stratified sand or gravel. Shallow wells and gravel pits are common in these soils.

Profile of Burleson clay (in cultivated field about 2 miles south of Five Points, and about 10 miles southwest of Waxahachie)—

A1p—0 to 4 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; weak, granular to moderate, very fine, subangular blocky structure; very hard when dry, firm when moist, plastic when wet; gray (10YR 6/1) surface crust ¼ inch thick; few fine pores; numerous concretions of iron on the surface; noncalcareous; pH 6.5; abrupt boundary.

A12—4 to 12 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; compacted by tillage; moderate, very fine, blocky structure; firm when moist, plastic when wet; few concretions of calcium carbonate; few concretions of iron; noncalcareous; pH 7.0; gradual boundary.

A13—12 to 26 inches, olive-gray (5Y 4/2) clay, dark olive gray (5Y 3/2) when moist; weak, blocky structure; very firm when moist, plastic when wet; few concretions of calcium carbonate as much as 5 millimeters in diameter; few, small concretions of iron; noncalcareous; pH 7.0; gradual, smooth boundary.

AC—26 to 40 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) when moist; massive (structureless); extremely firm when moist, stiff but plastic when wet; noncalcareous; pH 8.0; gradual, smooth boundary.

C—40 to 60 inches, olive (5Y 4/3) clay, olive (5Y 4/3) when moist; few, faint, yellow (5Y 7/8 moist) mottles; massive (structureless); extremely firm when moist, plastic when wet; few, hard concretions of calcium carbonate; noncalcareous; pH 8.0.

When dry, the surface layer ranges from dark gray (10YR 4/1) to dark olive gray (5Y 3/2). The C horizon ranges from gray (10YR 5/1) to olive (5Y 5/6). The surface layer is dominantly heavy clay, but in some places it contains a layer of light clay loam as much as 2 inches thick. This fine-textured layer crusts readily and is usually fairly gray in color. The thickness of the A and AC horizons combined ranges from about 30 to 70 inches. These horizons are thinnest in places where the soils are gently sloping.

About 72 percent of the total area of Burleson soils in Ellis County is on stream terraces and is commonly underlain by beds of sandy material at a depth ranging from about 6 feet to 20 feet. About 28 percent is on upland ridges and grades to clayey marl. A small area of about 60 acres is underlain by chalk bedrock at a depth of 42 inches.

Reaction of the surface layer ranges from pH 5.8 to 8.0. About 60 percent of the acreage mapped has a pH of about 6.0, and the rest has a pH ranging from 7.0 to 8.0.

Burleson soils have slopes that range from 0 to about 3 percent. A little more than half of the acreage mapped has slopes of less than 1 percent. A few areas in slight depressions have poor surface drainage.

Burleson soils are noncalcareous whereas the Houston Black soils are calcareous. Burleson soils are more crusty, more dense, and have slower internal drainage than Houston Black soils and the Hunt soils. They are less sandy in the surface soil than Wilson soils and are Grumusols instead of Planosols.

Burleson soils occur along the major streams of the county, mainly on terraces. Burleson clay is the only soil type in this series mapped in the county. These soils make up about 3 percent of the county.

Crockett series

In the Crockett series are moderately deep, grayish-brown, crusty Reddish Prairie soils that intergrade to Planosols. The surface layer is clay loam or fine sandy loam. The mottled, dense, medium acid subsoil grades to calcareous clay within a depth of about 60 inches. These soils developed under mixed native grasses and scattered post oaks.

Profile of Crockett clay loam, eroded (in abandoned field about 0.75 mile southeast of Telico and about 8 miles east of Ennis)—

Ap—0 to 5 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, granular structure; friable when moist, very sticky when wet; surface crust prominent where land is bare; many medium pores; stains by organic matter common; pH 6.0; clear boundary.

B21—5 to 10 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; many, yellowish-red (5YR 4/8) mottles, (5YR 3/8) when moist; moderate, medium, blocky structure; very firm when moist, very plastic when wet; few fine pores; peds have sharp angles and prominent clay films; pH 6.3; gradual, smooth boundary.

B22—10 to 16 inches, light-gray (5Y 7/2) clay, light olive gray (5Y 6/2) when moist; common, yellowish-red (5YR 4/8) mottles, (5YR 3/8) when moist; weak, blocky structure; very firm when moist, very plastic when wet; few pores; soil very dense; many, prominent, dark reddish-brown splotches that contain iron concretions; pH 5.5; gradual, smooth boundary.

B3—16 to 26 inches, gray (5Y 6/1) clay, gray (5Y 5/1) when moist; common mottles, olive yellow (5Y 6/8) when moist; weak, blocky structure to massive (structureless); firm when moist, very plastic when wet; many dark reddish-brown splotches containtaining iron concretions; pH 5.0; gradual, smooth boundary.

C1—26 to 42 inches +, light-gray (5YR 7/1) clay, gray (5YR 6/1) when moist; common mottles, olive yellow (5Y 6/8) when moist; weak, blocky structure to massive (structureless); very firm when moist, plastic when wet; few, prominent concretions of iron; pH 6.5.

From about 60 to 70 percent of the area, the original A horizon has been removed by erosion or has been mixed with the B horizon by cultivation. When dry, the surface layer ranges from grayish brown (10YR 5/2) to brown (10YR 5/3) because erosion has exposed the B horizon in places.

In the fine sandy loam soil type, the surface layer is grayer than normal in most places and, when dry, ranges from gray (10YR 5/1) to dark grayish brown (10YR 4/2). Reaction of the surface layer ranges from pH 5.5 to 6.2. The B21 horizon of the fine sandy loam ranges from 4 to 12 inches in thickness and is mottled with yellowish red, olive, and reddish brown. The B2 horizon in many places is somewhat mottled with olive and olive yellow.

Crockett soils are gently sloping to sloping. About 37 percent of the area mapped is gently sloping, about 55 percent is moderately sloping, and about 8 percent ranges from moderately sloping to sloping. In most places the sloping soils are severely eroded.

These soils have rapid surface drainage and very slow internal drainage. They are droughty and crust readily. Because they have been eroded, Crockett soils have been abandoned in many places and are mainly in needlegrass, stunted bermudagrass, and mesquite.

The Crockett soils have a lighter colored surface layer than Wilson soils and a deeper colored, more mottled subsoil. They have a lighter colored surface layer than Payne soils and a greater range in slope.

Crockett soils make up less than 1 percent of the county. They occur mainly in small areas of the grayland section in the east-central part of the county.

Dougherty series

Soils in the Dougherty series are brown loamy fine sands on low terraces. They are Red-Yellow Podzolic soils that developed in slightly acid to weakly alkaline sandy alluvium. The alluvium consists of sediments that washed from the western part of the Trinity River watershed. These soils occupy slightly high parts of low terraces along the Trinity River in close association with the Stidham soils. Dougherty soils occur among large areas of Burleson, Houston Black, and Trinity soils. The native vegetation is elm, ash, cottonwood, a few hickory trees, and other hardwoods. These soils are well drained and are seldom flooded.

Profile of Dougherty loamy fine sand (11.6 miles east of Ennis and 5.8 miles northeast of the intersection of U.S. Highway No. 75 and farm road 1182)—

A1p—0 to 9 inches, yellowish-brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) when moist; stained in upper 2 inches by organic matter; single grain (structureless); loose when dry, very friable when moist; many medium pores; many fine, fibrous roots; pH 6.0; clear boundary.

B1—9 to 15 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) when moist; few organic-matter stains; weak, blocky structure; friable when moist, very sticky when wet; many medium pores; many, fine, fibrous roots; pH 6.5; gradual boundary.

B2—15 to 36 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, blocky structure; firm when moist but plastic when wet; many fine pores; many, fine, fibrous roots; pH 6.3; gradual boundary.

C1—36 to 60 inches +, yellowish-red (5Y 5/8) clay loam, yellowish red (5Y 4/8) when moist; weak, blocky structure; slightly hard when dry, firm when moist, plastic when wet; many fine pores; many, fine, fibrous roots; pH 6.0.

When dry, the surface layer ranges from light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/6). It is fine sandy loam to loamy fine sand. The A horizon ranges from 6 to 14 inches in thickness. Reaction ranges from pH 5.8 to 7.0.

The Dougherty soils have slopes as much as 3 percent, but slopes are dominantly about 1 to 2 percent. They have a red B horizon that is slightly more clayey than that in the Stidham soils.

Eddy series

Soils of the Eddy series are very shallow, well-drained, dark grayish-brown Lithosols. They have granular blocky structure. These soils developed under mixed native grasses on thick beds of white chalk or indurated chalky white marl of the Austin formation. The more sloping areas of these thin gravelly soils are generally wooded with scrubby Shumard oak.

Profile of Eddy gravelly clay loam (in cultivated field 5.2 miles west of Waxahachie on farm road 1446; site is 150 feet from a point on the south side of the road)—

A1p—0 to 6 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; 20 to 30 percent of horizon is angular and subangular fragments of hard chalk as much as 3 inches in diameter; moderate, medium, granular structure; crumbly and friable when moist, sticky and plastic when wet; strongly calcareous; abrupt boundary.

R-AC—6 to 30 inches, fragmented, platy chalk with clay loam, amounting to 5 percent of horizon, in interstices; clay loam is brown (7.5YR 5/2) to a depth of 18 inches and grades to pale brown at lower depth; fragmented chalk is without coatings of reprecipitated lime; diffuse boundary.

R—30 to 70 inches +, white (10YR 9/2), thick-bedded marine chalk in alternate soft and hard beds that are massive and harder at the top; harder beds can be broken easily with a pick and can be cut with a spade or with woodworking tools.

The A1 horizon ranges from dark brown to grayish brown (10YR 3/3 to 10YR 5/2) when dry, and from very dark brown to very dark gray (10YR 2/2 to 7.5YR 3.5/2) when moist. The texture of this horizon ranges from clay loam to light silty clay. Clay particles make up about 30 to 45 percent of the soil material. The chalk fragments make up 0 to 50 percent of the horizon. The content of calcium carbonate ranges from 5 to 40 percent. A second horizon of fragmented chalk is generally present and is several inches thick.

Eddy soils are gently sloping to moderately steep. In a few places slopes are as much as 30 percent, but dominantly they are about 5 percent. About 57 percent of the acreage has slopes of 3 to 8 percent, about 33 percent has slopes of less than 3 percent, and about 10 percent has slopes of 8 to 20 percent. The more sloping soils are on benches, where chalk crops out in many places.

These soils generally occupy the highest elevations in the area. They are well drained to somewhat excessively drained, but in many places seeps appear after rainy periods.

Eddy soils are closely associated with the Austin and Stephen soils. Eddy soils are thinner than the Austin soils and contain more chalk fragments and a lighter colored surface layer.

Only one soil type, Eddy gravelly clay loam, was mapped in this county. It is in the whiterock section in the west-central part and makes up about 8 percent of the county.

Ellis series

In the Ellis series are shallow, dense, olive clays that are underlain by unweathered shale. These soils are Lithosols that developed under mid and tall grasses and patches of cactus and mesquite. They are mainly calcareous but in small areas are noncalcareous. These soils crust and crack severely when they dry. They contain many crystals of gypsum and are gravelly in places. Unweathered shale crops out in areas of thin soil, and geodes (*6*) are common in the more eroded areas. These soils contain small slickpots in many places.

Profile of Ellis clay (in pasture on west-facing slope about 2 miles southeast of Maypearl; to reach site go from Maypearl east on gravel road along railroad for 1.7 miles; then turn right and go 0.2 mile into pasture)—

A—0 to 7 inches, olive (5Y 4/3) clay, dark olive (5Y 3/3) when moist; common, prominent mottles of pale olive (5Y 6/4) and olive yellow (5Y 6/6) when moist; weak to moderate, fine, blocky structure; extremely hard when dry, extremely firm when moist, plastic when wet; many small specks that are clear or in various shades of gray and brown; calcareous; pH 7.5; gradual, smooth boundary.

AC—7 to 10 inches, olive (5Y 4/4) clay, dark olive (5Y 3/4) when moist; common pale-olive (5Y 6/4) and olive-yellow (5Y 6/6) mottles; weak to moderate, fine, blocky structure to massive (structureless); shiny ped surfaces; extremely firm when moist, stiff and plastic when wet; many, small, clear, quartzlike pebbles; weakly calcareous; pH 7.5; gradual, smooth boundary.

C1—10 to 18 inches, olive (5Y 5/4) shaly clay, olive (5Y 4/4) when moist; 30 percent shale by volume; light olive brown (2.5Y 5/6) and olive brown (2.5Y 4/6) when moist; very thin to thin, platy structure; clay films on surface peds; extremely firm when moist, stiff and slightly plastic when wet; lumps of gypsum ½ inch in diameter; pH 5.0; gradual boundary.

R—18 to 28 inches +, yellowish-brown and brown, compact shale with bulk density estimated to be about 1.9; weakly calcareous.

When dry, the surface layer ranges from olive gray (5Y 5/2) to olive (5Y 4/3). The A horizon is about 4 to 10 inches thick and grades to the AC horizon, which is more olive and usually mottled. The surface layer is heavy clay but is somewhat shaly in eroded areas. A residue of gypsum is on the surface of eroded soils. Geodes (*6*) as much as 20 inches in diameter are in this layer. Mottles in the C1 horizon range from common to many. Reaction of the surface layer is about pH 7.5. The shale below the solum is noncalcareous in about 50 percent of the area.

Ellis soils have rapid to very rapid surface drainage and very slow internal drainage. Slopes range from about 3 to 12 percent.

The Ellis soils are more olive and thinner than the Houston soils and are more crusty and less granular. They are more olive, more crusty, and harder than Sumter soils. They grade to unweathered shale at a shallower depth than do Houston and Sumter soils.

Ellis soils occur west of the Austin formation and are underlain by Eagle Ford shale. They are mainly adjacent to the Austin chalk escarpment in the western part of the country. Most of these soils are moderately eroded to severely eroded. Ellis soils make up about 5 percent of the county.

Frio series

In the Frio series are dark grayish-brown, strongly calcareous Alluvial soils that are deep and well drained. These soils developed under woody plants in fine-textured and medium-textured alluvium on the flood plain of streams. The subsoil commonly contains stratified sand and gravel. In most places the surface of Frio soils is slightly wavy. In this county much of the area in Frio soils is along streams that flow from areas of Austin soils.

Profile of Frio silty clay (in a cultivated field about 10 miles northeast of Waxahachie; to reach site take farm road 813 to a point 0.5 mile east of Rockett; then turn right and go 1.5 miles; turn right again and go 0.5 mile on gravel road; site is 300 feet north of road)—

A1p—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; strong, medium, granular and fine, subangular blocky structure; hard when dry, firm but crumbly when moist; strongly calcareous; gradual, smooth boundary.

A12—8 to 12 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) when moist; moderate, medium, platy structure; compacted; very hard when dry, firm when moist; few very fine concretions of calcium carbonate; strongly calcareous; gradual, smooth boundary.

A13—12 to 40 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate to strong, medium, granular and fine, subangular blocky structure; hard when dry, firm but crumbly when moist; few small concretions of calcium carbonate less than 3 millimeters in diameter; strongly calcareous; gradual, smooth boundary.

AC—40 to 48 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; strong, fine, subangular blocky structure; hard when dry, firm but crumbly when moist; many small concretions of calcium carbonate less than 3 millimeters in diameter; strongly calcareous; gradual, smooth boundary.

C—48 to 60 inches, gray (10YR 5/1) silty clay, dark gray (10YR 4/1) when moist; weak, subangular blocky structure; soft when dry, very friable when moist; many small concretions of calcium carbonate less than 3 millimeters in diameter; strongly calcareous.

When dry, the surface layer ranges from grayish brown (10YR 5/2) to dark brown (10YR 4/3). It is silty clay to loam. In most places all horizons contain lenses of coarser material. Their texture ranges from silty clay to loam to a depth of 30 inches. In most places the soil contains concretions of lime, and in many places concretions of iron. The substratum ranges in texture from clay to loam and in places contains thin lenses of loamy fine sand. Frio soils are strongly calcareous; reaction is about pH 8.3.

The surface layer of Frio loam is dominantly lighter colored than that of the silty clay. When dry, these soils are typically grayish brown (10YR 5/2), but they range from grayish brown to brown (10YR 5/4).

Frio soils are browner than Trinity soils and more sandy, more permeable, and better drained. Also, they are more friable and more crumbly.

These well-drained soils occur on nearly level to slightly undulating flood plains along most streams in the county. About 72 percent of the acreage is flooded frequently. Silty clay and loam were mapped in Ellis County, but the loam makes up only about 4 percent of the acreage. The total acreage of Frio soils amounts to about 1.6 percent of the county.

Houston series

Soils in the Houston series are deep, dark olive-gray clays. They are sloping Grumusols that developed under tall grasses. The parent material is calcareous clay or clayey shale, depending on where the soils occur in the county. These soils are strongly calcareous, crack when they dry, and are on slopes that range from 2 to 8 percent.

Profile of Houston clay (in a cultivated field about 14 miles south of Waxahachie; to reach site go east from Forreston on hardtop road for 4 miles; then turn right and go 1 mile on gravel road; then turn left and go 0.4 mile; turn right again and go 0.3 mile to cattle guard; site is 200 yards east on slope)—

A1p—0 to 3 inches, dark olive-gray (5Y 3/2) clay, black (5Y 2/2) when moist; moderate, fine to medium, granular structure; hard when dry, very sticky when wet; few rounded pebbles as much as 1 inch in diameter on surface; strongly calcareous; abrupt, smooth boundary.

A12—3 to 9 inches, olive-gray (5Y 4/2) clay, dark olive gray (5Y 3/2) when moist; strong, very thick, platy structure and moderate, fine, blocky structure; compacted by tillage; very hard when dry, very firm when moist, plastic when wet; few pebbles 2 millimeters in diameter; few concretions of iron; strongly calcareous; gradual, smooth boundary.

AC—9 to 34 inches, olive (5Y 4/3) clay, dark olive (5Y 3/3) when moist; streaks of dark material from surface soil in cracks; moderate, fine, angular to subangular blocky structure; very firm when moist, stiff and very sticky when wet; few concretions of iron; many concretions of calcium carbonate; few hard pebbles 3 to 4 millimeters in diameter; strongly calcareous; gradual, smooth boundary.

C—34 to 46 inches +, olive (5Y 5/4) clay, olive (5Y 4/4) when moist; many olive-yellow (5Y 6/6) mottles, olive (5Y 5/6) when moist; weak, blocky structure to massive (structureless); extremely firm when moist, stiff when wet; few concretions of calcium carbonate; strongly calcareous; slightly weathered.

When dry, the A horizon is dominantly olive gray (5Y 5/2) but ranges from olive gray (5Y 4/2) to dark gray (10YR 4/1). When moist it is dark olive gray (5Y 3/2). The solum is thinnest on the microknolls. Because of the knolls, the moderate slopes appear slightly undulating, the highest ridges being browner than the microbasins or valleys. Reaction of all horizons is about pH 8.0. A few small areas that are noncalcareous in the surface layer are included in areas mapped as Houston soils.

Slopes range from about 2 to 8 percent. About 13 percent of the area is gently sloping, about 57 percent is moderately sloping, and about 30 percent is sloping. Many areas are adjacent to areas of higher lying, nearly level Houston Black soils and receive runoff from them.

Houston soils are thinner and less dark throughout than Houston Black soils and are more sloping and more eroded. Salt crystals can be seen after rains in eroded Houston soils. The Houston soils are darker colored than the Sumter soils and are less sloping, less shallow, and not so severely eroded. They are thicker and less dense than Ellis soils and contain less gypsum. Also, the Houston soils do not crust so severely as the Ellis soils and have a faster rate of water intake.

Houston soils are well distributed in the county. They occur in most sloping areas, except in areas where the Austin formation crops out. They occupy about 10 percent of the county.

Houston Black series

Soils of the Houston Black series are very dark gray deep, calcareous Grumusols on uplands. They devel oped under tall grasses. The parent material consist of chalk, strongly calcareous clay over shale, and old alluvium. Wide cracks are characteristic of these soils, for the soils crack severely when they dry. Slopes are less than 3 percent.

Profile of Houston Black clay (in a cultivated field about 2 miles southeast of Waxahachie; to reach site from Waxahachie take farm road 878 and go east 1 mile; then turn right on farm road 879 and go 0.25 mile; then turn left on dirt road and go 0.75 mile; site is 100 yards from a point on south side of road)—

A1p—0 to 6 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; gray (10YR 5/1) soft crust ¼ inch thick on dry soil; moderate, fine, blocky structure; firm when moist, very plastic when wet; many medium pores; few concretions of calcium carbonate; few, small, hard, rounded pebbles on surface; abundant, fine, fibrous roots from wheat; strongly calcareous, clear boundary.

A12—6 to 16 inches, very dark gray (10YR 3/1) clay; black (10YR 2/1) when moist; strong, fine, blocky structure; very firm when moist, very plastic when wet; few, very small, hard concretions of calcium carbonate; many, fine, fibrous roots; few concretions of iron; ped surfaces slick and shiny; strongly calcareous; gradual, smooth boundary.

A13—16 to 40 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, medium to coarse, blocky structure; very firm when moist, plastic to stiff when wet; few, very small concretions of iron and calcium carbonate; many, fine, fibrous roots; few yellowish-red specks; strongly calcareous; gradual, smooth boundary.

AC—40 to 70 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, medium, blocky structure; very firm when moist, plastic when wet; many concretions of calcium carbonate; few concretions of iron; few, very small, reddish-yellow specks (7.5YR 6/8 moist); strongly calcareous; gradual, smooth boundary.

C—70 to 80 inches +, dark olive-gray (5Y 3/2) clay, black (5Y 2/2) when moist; few, olive (5Y 5/4) and gray (5Y 6/1), diffuse mottles; many, very small, reddish-yellow (7.5YR 6/8) specks; weak, blocky structure to massive (structureless); very firm when moist, very plastic when wet; more dense than AC horizon; many concretions of calcium carbonate; few concretions of iron, 2 to 5 millimeters in diameter; strongly calcareous; grades to marl at a depth of 84 inches.

When dry, the surface layer ranges from dark gray (10YR 4/1) to black (10YR 2/1). The A and AC horizons combined range from 40 to 70 inches in thickness; they are thinnest in the more sloping areas. Hard, rounded, siliceous pebbles of chert, flint, and jasper occur in places where the soil developed from the Taylor marl. A few chalky fragments of pebble size are common where the soil developed from the Austin chalk. Thin fragments of hard, brown limestone are common where the soil developed from the Eagle Ford shale.

In some areas where Houston Black soil is underlain by the Taylor marl, the soil contains hard, rounded pebbles that make up about 5 to 10 percent of the soil mass. In such areas, the soils are somewhat more productive than soils that do not contain pebbles. Reaction of the surface layer is about pH 8.0.

Houston Black soils in native pasture commonly have a gilgai microrelief of alternating basins and knolls. These basins and knolls average about 8 to 12 feet across. The soil in the microbasins is darker to a greater depth than that on the knolls and occasionally is noncalcareous. In cultivated fields plowing has mixed the surface layer with soils from both the microbasins and microknolls. A wavy boundary separates the AC horizon from the C horizon.

Houston Black clay is nearly level to gently sloping. About 25 percent of the acreage is nearly level, and runoff is slow from the more nearly level areas. About 70 percent of the area is dominantly very gently sloping and only slightly eroded. About 5 percent is gently sloping and moderately eroded.

Houston Black soils are deeper and contain more clay and fewer chalk fragments than Austin soils and are darker throughout and generally less sloping. Where they are near Austin soils, they normally are underlain by chalky bedrock like that underlying Austin soils. In all other places in the county, Houston Black soils grade to clayey shale or to calcareous clay. Houston Black soils are deeper, darker, and less sloping than Houston soils, which are eroded in most places. They are calcareous whereas Hunt soils are noncalcareous. They crust less than Hunt soils and are more self-mulching. Also, they contain fewer concretions of iron than Hunt soils, which grade to marl throughout the county. Houston Black soils are less olive, less dense, less crusty, and more granular than Ellis soils. They have a lower content of gypsum than those soils, and generally are less sloping. Houston Black soils have developed from shale and are deeper to shale than Ellis soils. They are less crusty, less dense, and more permeable than Burleson soils.

Houston Black clay, the only soil type mapped in this county, amounts to about 28 percent of the county. It is important for general farming and produces good yields.

The Houston Black clays on stream terraces are mapped separately. These soils developed mainly under tall prairie grasses and scattered patches of hardwoods. The parent material is calcareous, old alluvium. Beds of stratified, water-bearing sand and gravel underlie about 50 percent of the area at a depth of 10 to 30 feet. Native pecan trees are common on these soils, mainly in better drained areas.

When dry, the A1 horizon ranges from gray (10YR 5/1) to black (10YR 2/1) but is commonly very dark gray. Areas that are gray are somewhat crusty and contain fewer concretions of calcium carbonate than the darker colored areas. Reaction of the surface layer ranges from pH 7.5 to 8.2.

Slopes are as much as 3 percent, but 57 percent of the area has slopes of less than 1 percent.

Houston Black clay, terrace, occurs on stream terraces with Burleson clay, terrace; Wilson clay loam, terrace; and nearly level to gently sloping soils of the Lewisville series. Houston Black clay, terrace, occurs along the main streams throughout the county. It occupies nearly level benches that are easily farmed and makes up about 21 percent of the total acreage of Houston Black soils.

Hunt series

Soils of the Hunt series are dark-gray, deep, noncalcareous Grumusols on uplands. They developed under tall grasses and patches of hardwoods. Parent material consists of clayey marl of the Taylor formation. These soils are slightly crusty and crack when they dry.

Profile of Hunt clay (in a cultivated field about 8 miles east of Waxahachie and 0.75 mile east and 0.25 mile north of Boyce)—

A1p—0 to 7 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, very fine, blocky structure and medium, granular structure; firm when moist, very plastic when wet; iron concretions on surface and in horizon; noncalcareous; pH 7.5; clear boundary.

A12—7 to 16 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, fine, blocky structure; very firm when moist, very plastic when wet; compacted by tillage; surface of peds very black, shiny, and slick; few small concretions of iron; many, fine, fibrous roots; noncalcareous; pH 7.8 +; gradual, smooth boundary.

A13—16 to 28 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; weak to moderate, medium, blocky structure; very firm when moist, very plastic when wet; soil very dense; few fine pores; few small concretions of iron; noncalcareous; pH 8.0; gradual, smooth boundary.

A14—28 to 42 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; weak to moderate, blocky structure; very firm when moist, very plastic when wet; many concretions of iron; few hard concretions of calcium carbonate; noncalcareous; pH 8.0; gradual, smooth boundary.

AC—42 to 60 inches +, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; prominent, dark yellowish-brown (10YR 4/4 moist) mottles; common, diffuse, olive-gray (5Y 4/2 moist) mottles; weak, blocky structure; very firm when moist, very plastic when wet; many salt crystals; many hard concretions of calcium carbonate; few concretions of iron; few, flat, shiny, thin, shell-like crystals; strongly calcareous; pH 8.0.

When dry, the A1 horizon ranges from dark gray (10YR 4/1) to black (10YR 2/1). The surface of unplowed fields is fairly gray after rains because a weak, very thin, grayish crust forms. The AC and C horizons range from dark gray (10YR 4/1) to olive gray (5Y 4/2) and are commonly mottled with pale olive, dark yellowish brown, and olive yellow.

Hunt soils contain many iron concretions throughout the solum. In most places these concretions are fairly numerous in the surface layer and are noticeable in unplowed areas. Hard, smooth, rounded, siliceous pebbles and a few small stones occur in many places on Hunt soils and amount to as much as 5 percent of the soil by volume. These pebbly areas produce higher yields than areas of typical Hunt soils, probably because they take in water better.

Hunt soils are gently sloping to nearly level. About 16 percent of the acreage is nearly level, and about 84 percent is gently sloping. Undisturbed areas have a well-developed pattern of microrelief.

Hunt soils differ from Houston Black soils mainly in being noncalcareous in the surface layer and lower in calcium carbonate in the rest of the solum. However, Hunt soils are more crusty than Houston Black soils and are slightly more dense in their subsoil. Also, they contain many iron concretions. They developed from only clayey marl or calcareous clay whereas Houston Black soils developed from chalk, old alluvium, clayey marl, and strongly calcareous clay over shale.

Hunt soils are more granular in the surface layer than Burleson soils but are not so dense, crusty, or slowly permeable. The Burleson soils developed mainly on stream terraces in moderately calcareous alluvium.

Hunt soils occur in the east-central part of the county, where they are underlain by Taylor marl. They amount to less than 1 percent of the county. Because they are smooth and nearly level to gently sloping, most Hunt soils are used for cultivated crops.

Lamar series

Soils of the Lamar series are calcareous, loamy Regosols. They developed in calcareous, earthy marine sediments that are low in minerals that weather readily. These soils developed under tall prairie grasses. Most areas are eroded because they were cultivated. Now they have been abandoned and are in wild pasture of coarse bunchgrasses, partridgepeas, briers, and grapevines. Pecan trees grow along the waterways. These soils are well dissected by natural drains and have slopes ranging from 2 to 12 percent.

Profile of Lamar clay loam (in an abandoned field about 30 miles east of Waxahachie in the Bristol community; to reach site go east from Palmer on farm road 813 for 5 miles; then turn left on dirt road and go 1.25 miles; site is on right side, 100 feet from road)—

A1—0 to 7 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; common, brownish-yellow mottles; moderate, medium, granular structure; friable when moist, very sticky when wet; weak surface crust; many, fine, fibrous roots; many worm casts; many hard concretions of calcium carbonate; strongly calcareous; pH 8.2; many medium pores; gradual boundary.

A12—7 to 16 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; moderate, medium, subangular blocky structure; friable when moist, very sticky when wet; many medium pores; many worm casts; many, fine, fibrous roots; strongly calcareous; pH 8.2; gradual boundary.

AC—16 to 36 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; scattered, fine, yellowish-brown spots; white nodules of calcium carbonate; weak, medium, blocky structure; slightly firm to friable when moist, hard when dry; many grass roots between peds; few concretions of calcium carbonate; strongly calcareous; pH 8.2; diffuse boundary.

C—36 to 62 inches +, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; dividing plane stained yellowish brown; moderate to strong, medium and thick, platy structure; compacted; calcareous without evident segregation of calcium carbonate; pH 8.2.

When dry, the surface layer ranges from grayish brown (10YR 5/2) through light olive brown (2.5Y 5/4) to light yellowish brown (10 YR 6/4). Color is more yellowish brown in gullies and in the more severely eroded areas than it is in uneroded areas. Flagstones of brown limestone occur in the subsoil in many places. In a few small areas that have never been cultivated the soil is noncalcareous and is about neutral to a depth of as much as 15 inches. The surface layer ranges from clay loam to heavy loam. Brownish mottles in the AC and C horizons range from none to distinct; these mottles do not indicate wetness.

Lamar soils are well drained and are on slopes that range from 2 to 12 percent. They commonly occupy sloping to moderately steep areas between areas of higher lying, gently sloping, deep soils and soils on the flood plain of large natural drains.

The Lamar soils are more granular throughout than the Sumter soils. They grade to platy marl whereas the Lewisville soils grade to old alluvium. Lamar soils are not so dark colored as Broken alluvial land, which is over chalky bedrock. They are more friable and granular than the Houston soils.

The Lamar soils occur in the northeastern part of the county near the Houston and Sumter soils. Lamar soils are also near Crockett and Wilson soils, which commonly occupy nearly level ridges. Lamar clay loam is the only soil type of this series mapped in Ellis County, and it makes up about 0.34 percent of the total acreage.

Lewisville series

Soils of the Lewisville series are deep, well-drained, dark-brown, granular clays and loams. These soils are Rendzinas that developed in beds of sloping alluvium. They are commonly underlain by water-bearing sand or gravel at a depth of 5 to 20 feet. The native vegetation was mainly tall grasses and patches of pecan, cottonwood, and other hardwoods. Erosion has removed the dark original surface layer from most of these soils, and uncrossable gullies are common. Many of the gullies have cut through the strongly calcareous C horizon into the stratified old alluvium.

Profile of Lewisville silty clay (in pasture; to reach site go south from Bardwell on farm road 984 to Bardwell cemetery; continue south on gravel road across Onion Creek; then turn left and go 0.2 mile; then turn right and go 0.3 mile; site is on right, 200 feet from road)—

A1—0 to 6 inches, dark-brown (10YR 4/3) silty clay, dark brown (10YR 3/3) when moist; strong, medium, granular to very fine, subangular blocky structure; firm but crumbly when moist, sticky when wet; many, fine, fibrous roots; earthworm casts make up 20 percent of horizon by volume; few small pebbles; many concretions of calcium carbonate; calcareous; smooth boundary.

A12—6 to 16 inches, dark yellowish-brown (10YR 4/4) silty clay, dark brown (10YR 3/4) when moist; strong, medium, granular to very fine, subangular blocky structure; firm but crumbly when moist, sticky and plastic when wet; many, fine, fibrous roots; many earthworm casts; few small pebbles; many, small, hard concretions of calcium carbonate; many, medium pores; strongly calcareous; gradual boundary.

AC—16 to 28 inches, yellowish-brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) when moist; moderate, medium, granular and very fine, subangular blocky structure; firm but crumbly when moist, sticky and plastic when wet; many, fine, fibrous roots; many concretions of calcium carbonate, which increase in number with increasing depth; many, medium pores; many worm casts; strongly calcareous; gradual boundary.

C1—28 to 36 inches, brownish-yellow (10YR 6/8) silty clay, yellowish brown (10YR 5/8) when moist; moderate, medium, granular and very fine, subangular blocky structure; firm but crumbly when moist, slightly sticky and slightly plastic when wet; many medium pores; concretions of calcium carbonate 5 to 10 millimeters in diameter make up about 20 percent of the horizon; strongly calcareous; gradual boundary.

C—36 to 52 inches +, yellow (10YR 7/6) sandy clay, brownish yellow (10YR 6/6) when moist; weak, granular structure; firm but crumbly when moist, slightly sticky when wet; horizon very moist; few small concretions of calcium carbonate; strongly calcareous.

When dry, the A horizon ranges from brown (10YR 5/3) to dark brown (10YR 3/3). The A horizon ranges from loam to silty clay, and the AC horizon ranges from heavy loam to light clay. The A and AC horizons combined range from 20 to 40 inches in thickness. Stratified coarse material underlies about 80 percent of areas mapped as Lewisville soils at a depth ranging from 5 to 20 feet. The reaction is strongly calcareous, and the pH ranges from 8.0 to 8.3.

Lewisville soils are well drained. They are nearly level to moderately steep and occur mainly on valley slopes between higher lying, nearly level areas and the flood plain. Less than 1 percent of the area mapped is nearly level, and only about 15 percent is gently sloping.

The Lewisville soils are browner and generally more sloping than Houston Black soils and are more crumbly, more granular, and more permeable. Their profile characteristics are somewhat similar to those of Austin soils, which occur on uplands underlain by chalk. Lewisville soils are similar to Frio soils but occur on valley slopes whereas Frio soils occur on flood plains.

About 8 percent of the acreage in Lewisville soils in Ellis County is loamy. These loamy soils are generally browner than the silty clays.

Lewisville soils are well distributed in the county. They occur on stream terraces along most of the larger streams and make up less than 4 percent of the total acreage.

Norge series

Soils of the Norge series occur with Payne and Lewisville soils on terraces, mostly along Chambers Creek. They are similar to the Payne soils but are brown or reddish brown and have a subsoil of red, unmottled sandy clay. They are redder than the Lewisville soils and are noncalcareous instead of strongly calcareous.

Profile of Norge fine sandy loam (in a cultivated field on the eastern side of the county road, 0.3 mile south of intersection of farm road 916 and western boundary of the county)—

A1p—0 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, very fine, granular structure to single grain (structureless); loose when dry, nonsticky when wet; surface crust, about one-quarter inch thick, crumbles readily when handled; pH 5.8; clear boundary.

B1—7 to 13 inches, dark reddish-brown (2.5YR 3/4) light sandy clay, dark reddish brown (2.5YR 2/4) when moist; weak, blocky structure; compacted by tillage; firm when moist, sticky when wet; few stains from organic matter; pH 6.0; gradual boundary.

B2—13 to 32 inches, weak-red (2.5YR 4/2) sandy clay, dusky red (2.5YR 3/2) when moist; few, prominent mottles, yellowish red (5YR 5/6) when moist; few stains from organic matter; weak, medium, blocky structure; hard when dry, firm when moist, plastic when wet; few concretions of iron in lower part; pH 6.0; gradual boundary.

B3—32 to 44 inches, yellowish-brown (10YR 5/6) clay loam, dark yellowish brown (10YR 4/6) when moist; faint, yellow mottles; weak, blocky structure to massive (structureless); very hard when dry, very firm when moist, plastic when wet; many soft concretions of iron about 3 to 5 millimeters in diameter; pH 6.3; gradual boundary.

C1—44 to 60 inches, yellowish-brown (10YR 5/8) fine sandy loam, dark yellowish brown (10YR 4/8) when moist; single grain (structureless); loose when dry, slightly sticky when wet; few concretions of iron; pH 6.5.

When dry, the uneroded surface layer ranges from pale brown (10YR 6/3) to dark brown (10YR 4/3), but in eroded areas the dark reddish-brown B horizon is exposed. In areas of thin soil where plowing has mixed the upper part of the B horizon with the fine sandy loam A horizon, the surface layer is fine sandy loam to light clay loam. Thickness of the A horizon ranges from 4 to 10 inches. Mottles in the B horizon range from few to many and from very prominent to faint. Reaction ranges from pH 5.0 to 7.0.

Slopes are dominantly about 2 to 3 percent. Norge soils occupy well-drained parts of broad stream terraces near the Payne soils. They are more sandy in the surface layer than Payne soils and more red in the sandy clay subsoil.

Payne series

Soils of the Payne series are nearly level to gently sloping, dark grayish-brown clay loams and fine sandy loams that are deep and noncalcareous. These Reddish Prairie soils have a dense, mottled subsoil that grades to moderately coarse material in most places at a depth of 7 to 10 feet. These soils occur mainly on terraces along streams and, in places, are slightly undulating.

Profile of Payne clay loam (in a field reached by going west from Maypearl on farm road 916 to Auburn store; site is 100 feet west of store and 100 feet north of road)—

A1p—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) when moist; weak, granular and very thick, platy structure; hard when dry, friable when moist, sticky and plastic when wet; unplowed surface crusted; few concretions of calcium carbonate on the surface; noncalcareous; pH 7.0; abrupt boundary.

B21—6 to 14 inches, dark-brown (10YR 3/3) clay, very dark brown (10YR 2/3) when moist; few reddish-brown (5YR 4/4) mottles in lower part when moist; weak, blocky structure; firm when moist, plastic when wet; few iron concretions; few fine pores; many small pebbles; compacted by tillage; noncalcareous; pH 6.5; gradual, smooth boundary.

B22—14 to 24 inches, olive (5Y 4/3) clay, dark olive (5Y 3/3) when moist; many mottles of yellowish red (5YR 4/6) when moist; weak, blocky structure; very firm when moist, very plastic when wet; no visible pores; many concretions of iron 3 millimeters in diameter; noncalcareous; pH 6.5; gradual, smooth boundary.

B3—24 to 36 inches, olive (5Y 4/4) clay, dark olive (5Y 3/4) when moist; few, very faint mottles of reddish yellow (5YR 6/6) when moist; weak, blocky structure to massive (structureless); very firm when moist, very plastic when wet; few concretions of iron in lower part; noncalcareous; pH 7.5; gradual, smooth boundary.

BC—36 to 44 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) when moist; massive (structureless); very hard when dry, very firm when moist, very plastic when wet; many concretions of calcium carbonate 5 to 10 millimeters in diameter; few iron concretions; clay appears to contain sand; weakly calcareous; pH 8.0; gradual, smooth boundary.

C—44 to 60 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) when moist; few olive (5Y 5/6) mottles when moist; massive (structureless); very hard when dry, very firm when moist, very plastic when wet; many concretions of calcium carbonate 3 millimeters in diameter; few iron concretions; clay appears to contain sand; calcareous; pH 8.0.

When dry, the surface layer ranges from brown (10YR 4/3) to dark brown (7.5YR 4/2) in color and from fine sandy loam to heavy clay loam in texture. The A horizon is 4 to 15 inches thick. Reaction of this horizon ranges from pH 6.0 to 7.0 but is dominantly 6.0. Mottles in the B horizon range from few to many. Reaction ranges from pH 5.8 to 8.0 and is more alkaline with increasing depth. The C horizon is noncalcareous in places. Depth to stratified sand or gravel commonly ranges from 7 to 10 feet, but this material may be absent in places.

Slopes are less than 3 percent. These soils generally occupy well-drained stream terraces. Internal drainage is slow. About 30 percent of the acreage in Payne soils is nearly level and has a clay loam surface layer.

Payne soils are similar to Wilson soils but are darker throughout. They are less sloping and less firm in the upper part of their subsoil than Crockett soils and occur on stream terraces whereas Crockett soils occur on uplands. Payne soils occur mainly along Chambers Creek and on low terraces along the Trinity River. Less than 2,000 acres of Payne soils occurs in the county.

Pratt series

Soils of the Pratt series are dark-brown to brownish-yellow, deep, slightly acid loamy sands. They are Chestnut soils that intergrade to Regosols. These soils occur on stream terraces, mainly along the Trinity River. Slopes are nearly level to gently sloping and are somewhat undulating in places. The native vegetation was hardwoods, briers, bull nettles, and other plants tolerant of drought. These soils are loose and are likely to blow if left bare.

Profile of Pratt loamy fine sand (at a point between Sand Land and gravel road; to reach site go east from Ennis 7.5 miles on State Route 34; turn north on gravel road and go 1 mile)—

A1—0 to 9 inches, dark-brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) when moist; weak, granular structure to single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; slightly compacted; pH 6.0; gradual, smooth boundary.

A12—9 to 20 inches, dark yellowish-brown (10YR 4/4) loamy fine sand, dark yellowish brown (10YR 3/4) when moist; single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; pH 6.0; gradual, smooth boundary.

A3—20 to 30 inches, yellowish-brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) when moist; single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; pH 6.0; gradual, smooth boundary.

B21—30 to 50 inches, brownish-yellow (10YR 6/5) loamy fine sand, yellowish brown (10YR 5/6) when moist; single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; noncalcareous; pH 6.5; gradual, smooth boundary.

B22—50 to 60 inches, brownish-yellow (10YR 6/8) loamy fine sand, yellowish brown (10YR 5/8) when moist; single grain (structureless); loose when dry, very friable when moist, slightly sticky when wet; noncalcareous; pH 6.5.

When dry, the surface layer ranges from grayish brown (10YR 5/2) to yellowish brown (10YR 5/4). It is dominantly loamy fine sand. Sand pits indicate that this soil is about 12 feet thick. In a few places, however, clay occurs at a depth of 50 inches, but generally texture does not change within a depth of 100 inches. Reaction of the surface layer ranges from pH 5.5 to 6.5.

The Pratt soils are well drained and occupy slightly undulating terraces just above the normal flood stage along the Trinity River. Slopes range from 0 to about 3 percent. These soils occur in Ellis County in small areas of gently undulating loamy sands on the flood plain of the Trinity River. They are on low benches and are closely associated with Trinity soils.

The Pratt soils are coarser textured and looser than Dougherty and Stidham soils, which have a more yellow, much finer textured subsoil. Only Pratt loamy fine sand was mapped. The total acreage is 517 acres.

Stephen series

Soils of the Stephen series are well-drained, dark-brown silty clays that have moderate, granular and subangular blocky structure. These strongly calcareous soils developed mainly under tall native grasses in thick beds of white chalk underlain by the Austin formation. They are gently sloping to sloping Brunizems and are well dissected by natural draws. In the more eroded areas the soils are lighter in color and more gravelly than normal.

Profile of Stephen silty clay (in a pasture about 5 miles southwest of Maypearl; to reach site go south from Maypearl on farm road 66 for 3.75 miles; turn left on gravel road and go 3.5 miles; then turn right on gravel road and go 1.75 miles; site is 0.33 mile north from road)—

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) light silty clay, slightly darker (10YR 3/2) when moist; moderate, medium, granular and fine, subangular blocky structure; no distinct ped coatings; firm when moist, slightly plastic and sticky when wet; many worm casts on surface and in horizon; many medium pores; stained by organic matter; many chalk fragments on surface and in horizon; strongly calcareous; gradual, smooth boundary.

A12—4 to 14 inches, vary dark grayish-brown (10YR 3/2) silty clay, slightly darker (10YR 3/2) when moist; strong, medium, granular and fine, subangular blocky structure; firm when moist, plastic when wet; many chalk fragments; many, fine, fibrous roots; many worm casts; many earthworms; strongly calcareous; clear boundary.

R-AC—14 to 24 inches, rubble consisting of about five parts platy fragments of chalk and one part light silty clay between fragments; silty clay is dark brown to a depth of 18 inches but grades to pale brown; abrupt boundary.

R—24 to 40 inches +, alternating soft and hard beds of white (10YR 9/2) marine chalk; hard beds break readily with pick and can be cut with woodworking tools.

When dry, the surface layer ranges from dark brown (7.5YR 4/2) to grayish brown (10YR 5/2). Thickness of the combined A and R-AC horizons ranges from 10 to 24 inches. Above the R-AC horizon, chalk fragments make up as much as 10 percent of the soil material.

Stephen soils are deepest in the small valleys and are shallowest on ridges, where they occur closely with Eddy soils. The reaction throughout the profile ranges from pH 8.0 to 8.3.

Slopes range from 1 to 5 percent. About 40 percent of Stephen soils is gently sloping; 25 percent is in a gently sloping, eroded complex with Eddy soils; and 35 percent is in a moderately sloping, eroded complex with Eddy soils.

The Stephen soils occur only in the west-central part of the county and are underlain by the Austin formation. They make up about 5 percent of the total acreage of the county.

Stidham series

Soils in the Stidham series are brown, well-drained loamy fine sands on low terraces along the Trinity River. They are Red-Yellow Podzolic soils that developed in neutral to alkaline sandy alluvium. Slopes are dominantly less than 3 percent but range to as much as 5 percent. Slight mounds are in the less sloping areas. The native vegetation was hardwoods. These soils are fertile and produce excellent pasture of Coastal and common bermudagrasses.

Profile of Stidham loamy fine sand (in pasture about 15 miles southeast of Ennis near the Trinity River; to reach site go south from Ennis on U.S. Highway No. 287 for 3 miles; then turn left on farm road 662, and go 12 miles and turn left into pasture; site is on the Taylor farm, 0.25 mile north of road)—

A1—0 to 6 inches, grayish-brown (10YR 5/2) loamy fine sand, dark brown (10YR 4/3) when moist; very weak, subangular blocky structure; somewhat loose when dry, very friable when moist, nonsticky when wet; many, fine, fibrous roots; stains of organic matter; many medium pores; pH 6.7; gradual boundary.

A12—6 to 14 inches, light yellowish-brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) when moist; single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; many, fine fibrous roots; porous; pH 6.5; gradual boundary.

A2—14 to 20 inches, very pale brown (10YR 7/2) loamy fine sand, pale brown (10YR 6/3) when moist; single grain (structureless); loose when dry, very friable when moist, nonsticky when wet; many fibrous roots; porous; pH 6.5; gradual boundary.

B21—20 to 30 inches, brownish-yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) when moist; few, medium, distinct, red (2.5YR 4/8) mottles; weak, subangular blocky structure that breaks to granular; friable when moist, slightly sticky when wet; many, fine, fibrous roots; porous; pH 6.0; gradual boundary.

B22—30 to 48 inches, reddish-yellow (7.5YR 6/8) light sandy clay, strong brown (7.5YR 5/8) when moist; common, distinct, medium, red (2.5YR 4/8) mottles; weak, subangular blocky structure that breaks to granular structure; firm when moist, slightly sticky when wet; many, fine, fibrous roots; porous; sand increases with increasing depth; pH 6.5; abrupt boundary.

B3—48 to 60 inches +, brownish-yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) when moist; weak, granular to subangular blocky structure; firm when moist, slightly sticky when wet; few, fine, fibrous roots; porous; somewhat sandier than B22 horizon; pH 7.0.

When dry, the surface layer ranges from light brownish gray (10YR 6/2) in cultivated fields to dark grayish brown (10YR 4/2) in areas recently cleared of timber. The A horizon ranges from 18 to 30 inches in thickness. It is loamy sand to loamy fine sand in most places but, in a few places, is fine sandy loam. Reaction of the surface layer ranges from pH 6.0 to 6.8.

The Stidham soils have a mottled, finer textured subsoil than the Pratt soils. They are finer textured than Wilson fine sandy loams and do not have a dense, gray subsoil.

The Stidham soils occur in the eastern part of the county along the Trinity River and were mapped in an undifferentiated soil group with Dougherty loamy fine sand.

Sumter series

Soils in the Sumter series are moderately deep, pale, calcareous, clayey Regosols. They developed under mid and tall grasses, but erosion has prevented the development of a dark surface layer. The parent material is clayey marl or shaly clay. These soils dominantly are strongly sloping, and they take in water slowly.

Profile of Sumter clay (in abandoned field about 15 miles southeast of Waxahachie; to reach site from intersection of farm road 877 and State Route 34, go southeast on gravel road 1.5 miles; site is about 100 yards west of road)—

AC—0 to 6 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) when moist; few, light yellowish-brown (10YR 6/4) mottles; moderate, fine, blocky and medium, granular structure; hard when dry, firm when moist; surface crust crumbles readily; calcareous; pH 8.0; gradual, smooth boundary.

C1—6 to 12 inches, olive (5Y 5/4) clay, olive (5Y 4/4) when moist; few, prominent, light yellowish-brown (10YR 6/4) mottles; weak, blocky structure; firm when moist, stiff and plastic when wet; many concretions of calcium carbonate; pH 8.0; calcareous; gradual, smooth boundary.

C2—12 to 24 inches, olive (5Y 5/3) clay; olive (5Y 4/3) when moist; common, brownish-yellow (10YR 6/6) mottles; medium, platy structure; very firm when moist, stiff and plastic when wet; many lime concretions; calcareous; pH 8.0; gradual, smooth boundary.

C3—24 to 44 inches +, olive (5Y 5/3) clay, olive (5Y 4/3) when moist; many, brownish-yellow (10YR 6/6) mottles; medium, platy structure; very firm when moist, stiff and plastic when wet; common concretions of lime; calcareous; pH 8.0; grades to clayey marl at 44 inches.

When dry, the surface layer ranges from grayish brown (2.5Y 5/2) to olive (5Y 5/4). Mottles in the C horizon range from light yellowish brown (10YR 6/4) to olive yellow (5Y 6/6). The AC horizon is as much as 10 inches thick but is absent in many eroded areas. Lumps and lenses of soft calcium carbonate range from few to many and are more numerous where the soil grades to slightly weathered clayey marl.

These well-drained soils are sloping to strongly sloping. Slopes range from 5 to 12 percent and are commonly in sloping areas between higher lying, gently sloping, deep soils and soils on the flood plain. Runoff from adjacent higher areas has formed gullies in many places.

Sumter soils are less dark and more sloping than Houston soils. They are not so dense and hard as the Ellis and Houston soils. Sumter soils are less friable and granular than Lewisville soils and are less permeable in the subsoil and do not grade to old alluvium.

Sumter soils occur mainly in scattered small tracts, where they are closely associated with Houston soils in sloping to strongly sloping areas. In the western part of the county they are underlain by Eagle Ford shale, and in the eastern part by Taylor marl. The Sumter soils make up only 1.42 percent of the county.

Trinity series

Soils in the Trinity series are dark, deep, calcareous clays on the flood plain of streams. They are Alluvial soils in sediments washed mostly from calcareous soils of the blackland prairie. The native vegetation is mainly hardwoods and grasses in open areas. These soils are nearly level and are slowly drained. They crack severely when they dry. Beds of sand and gravel underlie about 50 percent of the acreage of Trinity soils.

Profile of Trinity clay (in cultivated field about 10 miles northeast of Ennis; to reach site go northeast from Ennis on State Route 34 for 9.5 miles; then go southeast 0.25 mile; site is 50 feet from road on right side)—

A1p—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, fine, blocky and medium, granular structure; soft surface crust, ¼ to ½ inch thick, crumbles readily; slightly firm when moist, sticky and plastic when wet; porous; strongly calcareous; clear, smooth boundary.

A12—4 to 34 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; weak, blocky to moderate, fine, blocky structure; upper 8 inches compacted by tillage and has weak, platy structure; very firm when moist, very plastic when wet; porous; strongly calcareous; gradual, smooth boundary.

A13—34 to 50 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; common, pale-olive (5Y 6/4) mottles, olive (5Y 4/4) when moist; weak, blocky structure; very firm when moist, very plastic when wet; lenses of moderately coarse material; strongly calcareous; gradual, smooth boundary.

A14—50 to 60 inches +, very dark gray (5Y 3/1) clay, black (5Y 2/1) when moist; common, olive (5Y 5/3) mottles, olive (5Y 4/3) when moist; weak, blocky structure; very firm when moist, very plastic when wet; many hard concretions of calcium carbonate; slightly stratified; more uniform in color than the A13 horizon above; porous; strongly calcareous.

When dry, the surface layer ranges from gray (10YR 5/1) to olive gray (5Y 5/2) but is dominantly dark gray or very dark gray. If they formed from alluvium washed from Houston and Ellis soils, Trinity soils are likely to be olive and dark yellowish brown. Also, these soils may be somewhat mottled with olive and olive yellow in the subsoil. Trinity soils are dominantly heavy clay, but in many places the lower part of the profile contains lenses of moderately coarse material. All horizons have a pH of about 8.0.

Trinity soils occur on the flood plain of streams and have slow surface drainage. They are mainly nearly level, and some areas are in slight depressions. Internal drainage is generally slow, but in those soils that have a loamy substratum it is medium. About 63 percent of the acreage of Trinity soils is flooded frequently.

Trinity soils are darker throughout and less granular than Frio soils and have finer texture, slower permeability, and slower surface drainage.

Trinity clay, loamy substratum, grades to the loamy material at a depth of about 30 inches in most places, but the depth to the loamy layer ranges from 18 to 40 inches. In most places, the loamy substratum is reddish yellow (7.5YR 6/8) to yellowish brown (10YR 5/4) when dry. These areas are somewhat subirrigated by a moderately shallow water table. Gravel pits are common on these soils. Scattered large pecan trees occur.

Trinity soils are well distributed in the county. The largest areas are on the flood plains of the Trinity River, Chambers Creek, and Waxahachie Creek. These soils amount to about 11 percent of the county.

Wilson series

Soils of the Wilson series are deep, dark-gray Planosols. These soils developed in calcareous clay under tall grasses. They are slightly acid to medium acid in the surface layer. Texture of the surface layer is clay loam or fine sandy loam. The subsoil is dense, very slowly permeable clay. Slopes range from 0 to about 3 percent. Wilson soils crust readily.

Profile of Wilson clay loam (in a cultivated field about 10 miles southwest of Ennis; to reach site from Ennis go southwest on State Route 34 for 2.5 miles; then go south on gravel road 6 miles; then turn right and go 0.3 mile; then turn left and go 0.8 mile; then turn right and go 0.2 mile; then turn left and go 0.2 mile on dirt road; site is 60 feet southeast of intersection)—

A1p—0 to 5 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; friable when moist, very sticky and plastic when wet; weak surface crust, one-quarter inch thick; many worm casts; many medium pores; many, fine, fibrous roots; pH 6.3; abrupt boundary.

B2—5 to 38 inches, dark-gray (10YR 4/1), dense clay; very dark gray (10YR 3/1) when moist; moderate, fine to medium, blocky and subangular blocky structure; very firm when moist, sticky and stiff when wet; few, fine, fibrous roots; few concretions of iron and calcium carbonate in lower part; thin continuous clay films; few gypsum crystals in lower part; noncalcareous; pH 6.7; gradual boundary.

C1—38 to 44 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; massive (structureless); very firm when moist, stiff when wet; many small concretions of calcium carbonate and iron; calcareous; pH 8.0; gradual boundary.

C—44 to 70 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) when moist; weak, blocky structure to massive (structureless); very hard when dry, very firm when moist, plastic when wet; few concretions of iron; many small concretions of calcium carbonate; few gypsum crystals; few lenses or thin strata of sandy clay in places; strongly calcareous; pH 8.0.

The A horizon ranges from clay loam to fine sandy loam. The A horizon of Wilson clay loam ranges from gray (10YR 5/1) to very dark grayish brown (10YR 3/2). Wilson fine sandy loam is slightly lighter colored. The B2 horizon ranges from dark gray (10YR 4/1) through black (10YR 2/1) to dark olive gray (5Y 3/2). This horizon may contain few to common, faint mottles of yellowish brown, gray, and pale olive. The C horizon ranges from gray (10YR 5/1) to olive (5Y 5/4).

Reaction of the A horizon ranges from pH 5.5 to 6.5, and that of the B2 horizon from pH 6.0 to 7.0. Thickness of the A horizon generally ranges from 5 to 15 inches, but it may be thicker where sediment has accumulated. Thickness of the B2 horizon ranges from 18 to 30 inches.

The A horizon of Wilson fine sandy loam is commonly 7 to 10 inches thick and crusts more readily than that in the Wilson clay loam. About 13 percent of the total area of Wilson soils is fine sandy loam.

Slopes range from 0 to 3 percent. About 15 percent of the acreage in Wilson soils is nearly level, and about 85 percent is gently sloping. About 20 percent of the acreage on terraces is nearly level, and most of the rest on terraces has slopes of 1 to 2 percent.

Wilson soils are less sloping and have a darker colored surface soil than Crockett soils and are less brown and less strongly mottled in the subsoil. Wilson soils have a coarser textured surface layer than Burleson soils.

Most areas of Wilson soils occur in the grayland of the eastern part of the county and have calcareous clayey parent material. They make up about 5 percent of the total acreage of the county.

General Facts about Ellis County

This section was prepared for those who want general information about Ellis County. It discusses briefly the history of the county; the progress of soil and water conservation and flood prevention; and the climate, agriculture, and other subjects of general interest.

History

The earliest known inhabitants of the area were the Tonkowa, Kickapoo, Bidai, Anandarko, and Waco Indians. They hunted buffalo and other game that grazed the tall grasses on the blackland prairie. In about 1846 the first white men settled in this area. Population increased rapidly, and in 1849 Ellis County was created by an act of the State Legislature of Texas. The county was formed from part of Navarro County. It was named for Richard Ellis, who was President of the Constitutional Congress that declared Texas independent of Mexico. One branch of the famed Old Chisholm Trail crossed Ellis County and was the route cattle were driven northward from the southern part of Texas to rail points in Kansas City. This branch went through the area where the town of Waxahachie is now located. Waxahachie, the county seat, was organized in 1861 and is the oldest town in the county. It increased in population from 1,354 in 1880 to 12,749 in 1960.

Transportation

Ellis County is crossed by four north-south United States Highways. U.S. Highway No. 67 passes through Midlothian in the northwestern part of the county; U.S. Highway No. 75 (I-45), which connects Dallas and Houston, is in the eastern part of the county and passes through Ennis; U.S. Highway No. 77 passes through Waxahachie and connects Dallas, Austin, and San Antonio; and U.S. Highway No. 287 passes through Waxahachie and connects Fort Worth and Houston. Highways Nos. 75 and 77 are part of the Interstate Highway System and have limited access and service roads. Highway No. 77 is Interstate 35, and No. 75 is Interstate 45.

All communities in the county are served by hard-surface roads. The State maintains approximately 250 miles of these roads. From various parts of the county 12 hard-surface roads run into Waxahachie, and 2 U.S. Highways intersect there. In addition to these roads there are about 1,100 miles of county roads.

Six railroads cross the county, generally paralleling the U.S. Highways. Most of the towns in the county have rail service.

Industries

During the past 20 years many industrial plants have been established in Ellis County. Operating in Waxahachie are a garment company, a plant that makes trousers, a refrigeration plant, a steel corporation, a packing company, and many smaller plants. Ennis has a railroad shop and a number of small plants.

Several other small plants are located throughout the county in Italy, Midlothian, Ferris, and other towns. Mills that process cottonseed oil are located in Ennis, Waxahachie, and Midlothian. Livestock auctions are held at Ennis and Midlothian, and cement is made at Midlothian from chalky rock quarried nearby.

Natural Resources

Soil is the most important natural resource in Ellis County. Strong native grasses grew on the soils of the blackland prairie and attracted the first settlers. When these soils were taken out of grasses and planted to cotton, they produced good yields. Cotton, a cash crop, played the major role in the early development of the county.

Obtaining water was somewhat of a problem during the early days of the county, for underground water is deep in some areas. In the whiterock area, dependable supplies of water must come from beneath the chalk bedrock, which extends to a depth of 600 to 800 feet. Power is needed to pump water from this depth, and it was not available in the early days. Areas of the county that had a sand or gravel substratum under the soil furnished ample water at a depth of 10 to 20 feet.

Deposits in the county have provided enough sand and gravel to meet local needs in recent years. These deposits are mainly under soils on benches along the larger streams. The chalk from the Austin formation and shale from the Eagle Ford formation provide material for manufacturing cement. A new plant near Midlothian uses these materials. Marl from the Taylor formation is used for making brick in plants at Palmer and Ferris.

A shallow oilfield in the southeastern part of the county has approximately 180 pumping wells.

Cultural Facilities

People in Ellis County have access to many cultural facilities other than those within the county because the county is a part of the Greater Dallas Metropolitan area. This large area provides many facilities for the inhabitants of the county.

Churches are well distributed in the county. Waxahachie has 41 churches. Each of the other towns has several churches, and most small communities have one or more.

There are 12 school districts in the county, and 11 of them offer all the 12 grades that are taught in Texas public schools. Schools are distributed in the county, and children in all communities are provided transportation to and from school.

The major newspapers from Dallas and Fort Worth are delivered daily in the county. Newspapers are published daily or weekly in Waxahachie, Ennis, and most of the smaller towns. Waxahachie has a radio station that broadcasts county news to supplement the broadcasts from stations in Dallas and Fort Worth.

Agriculture

For several years after 1900, Ellis County led all other counties of Texas in cotton production.

Farms were small and were worked mostly by family labor. In 1930 the average-size farm was approximately 87 acres. At that time the county had 6,082 farms, of which 4,682 were operated by tenants. Farm power was provided by about 18,000 work animals, mostly mules, and by fewer than 400 farm tractors. In about 1930 farmers began to replace animals with tractors, and by 1945 most farmers were using tractors.

With this change to mechanical power, the size of farms increased, and the number of farms decreased. In 1960 there were about 2,070 farms that averaged about 258 acres. About 32 percent of these were operated by tenants.

The number of cattle has increased in the county in the past several years. In 1920 there were 2,249 beef animals and 13,249 dairy animals on farms in the county. Most of the dairy animals were distributed a few per farm and provided milk for home use. In 1960 the county had about 43,000 beef animals and 2,500 dairy animals. The dairy cows are mainly in commercial dairy herds. Most of these herds are in the whiterock area where the soils are thin.

When the need to maintain about 18,000 horses and mules was eliminated, the number of beef cattle increased. Most farmers in the county keep a small herd of beef cattle, and several are producing purebred herds.

The number of hogs decreased when the number of farms decreased. In 1920 there were approximately 22,000 hogs in the county, and these were mainly used to furnish meat for the farm homes.

Ellis County has a good transportation system and is close to the markets in Fort Worth and Dallas. Consequently, the numbers of commercial dairies, large flocks of turkeys, laying hens, and broilers have constantly increased in recent years. The number of sheep flocks is also increasing.

The acreage of different crops has changed with the shift in farm operations. At one time cotton was the main cash crop, and most of the land that was not needed to grow feed for farm use was planted to it. But the acreage in cotton has been reduced by acreage controls and soil erosion. In 1960 cotton was grown only on about 130,373 acres in the county.

Grain sorghum has increased in acreage in recent years and now provides a cash income. The acreage planted to grain sorghum increased from about 1,000 acres in 1934 to about 50,000 acres in 1960. The development of hybrid varieties that produce higher yields has contributed much toward expanding the acreage. Of particular interest is a low-heading variety that can be harvested by combines.

The use of the combine harvester has also resulted in an increase in the acreage of small grains, sweet clover, and soybeans. Income from the sale of these crops replaces income lost through the reduced acreage of cotton.

Soil and Water Conservation

Many of the soils in Ellis County were damaged when they were planted to cotton and conservation was not practiced. Fields were farmed in straight rows that extended in the direction of slope. The soil was left bare in winter without protection from erosion. When the soil conservation movement started and soil conservation districts were organized, three of these districts were established in different parts of the county. The Ellis-Prairie Soil Conservation District was organized in 1940 and includes about 92 percent of the county. In the Mountain Creek watershed in the northwestern part of the county, the Dalworth Soil Conservation District includes approximately 25,000 acres northwest of the Santa Fe Railroad. This district was organized in 1941. The Navarro-Hill Soil Conservation District includes about 23,000 acres south of Mill Creek in the southwestern part of the county.

The present trend in the county is to establish grasses and other soil-conserving crops on soils that are susceptible to erosion. From 1950 to 1960, approximately 60,000 acres of grasses were established.

Ellis County is a leading county in the State in the movement for improved soil and water conservation. The goal of the soil conservation districts is to have a well-balanced plan for soil and water conservation on each farm.

Local farmers and ranchers participate in the conservation program voluntarily. They obtain technical assistance from the Soil Conservation Service, information from the Texas Agricultural Extension Service, and financial assistance from the Agriculture Stabilization and Conservation Service and from the Farmers Home Administration. Owners of approximately 75 percent of the land have an agreement to obtain assistance from the soil conservation districts in the county. About 3,200 miles of terraces have been built. These terraces empty onto about 2,650 sodded waterways and protect about 77,000 acres of cropland. The average size of the waterways is about 2.4 acres. The waterways are mainly on soils that are likely to erode if they are not sodded. Because of erosion, yields in most areas were low before the sodded waterways were established. About 75,000 acres are terraced and farmed on the contour. Approximately 100 miles of diversion terraces have been built. These diversion terraces are designed to protect the soils by intercepting runoff from the slopes above. They are similar to regular terraces but generally are larger and farther apart.

Farmers have improved their soil management in recent years. They know that heavy clays need careful management and that good yields cannot be maintained if the row crops are grown continuously. Farmers know that these soils pack if they are plowed wet, that they need regular applications of organic matter from high residue-producing crops, and that soils need deep-rooted crops and sod crops that will keep them open and permeable to water and to plant roots. Farmers are aware of the requirements of their soils and are beginning to use appropriate practices.

Farmers have also changed their cropping sequences. Small grains, legumes, and other close-growing crops have been added to the cropping system and are used as cover crops. Residue from crops is shredded and left on the soil, and large applications of fertilizer are used. Inoculated legumes are planted on soils suited to them. In addition, pastures are established by seeding or sodding. These pastures are mowed regularly, fertilized, overseeded with legumes, and otherwise managed well. To help distribute grazing on these pastures, 5,500 ponds for watering livestock have been built.

Production records show that, on some farms, the yield of cotton per acre has steadily decreased, although better varities of cotton have been developed. Because of acreage allotments and the increase in livestock production, only the best soils are planted to cotton. Nevertheless, the average yield per acre for the county remains about the same. Even on soils of the blackland, which are the best suited in the county for cotton, the yield per acre is only slightly higher than the average.

Climate [3]

A subhumid climate prevails in Ellis County, and temperatures are moderate. This climate affects agriculture mainly by (1) an irregular seasonal distribution of the rainfall, (2) a fairly high rate of evaporation, (3) a temperature of more than 100° F. for several days in summer, and (4) moderate winters in which cold spells rarely last more than several days.

Table 6 summarizes data on climate recorded at Waxahachie in Ellis County.

The mean annual precipitation at Waxahachie for the period of 1931 to 1961 was 35.11 inches. Extremes of precipitation for this area were a minimum of 21.94 inches in 1954 and a maximum of 54.82 inches in 1957. The annual precipitation fluctuates from year to year, but the distribution is favorable for crop production because about 60 percent of the yearly total falls in spring and summer. But much rain falls as light, ineffective showers during the growing season. Excessive amounts that generally fall in spring delay planting, keep the soil cold, and cause erosion. Crop yields may be good if rain is low but is well distributed. They may be poor if rainfall is high but is poorly distributed, or if it comes in light showers. Light showers wet only a few inches of the surface layer, and most of the moisture is lost through evaporation. Because clean cultivation is common in the county, a large percentage of water from heavy rains is lost through runoff, especially if the soil is already wet when the rain starts.

The mean average relative humidity for the area is 65 percent. It varies from 80 percent at 6:00 a.m. to 53 percent at 6:00 p.m. Because of this humidity, the mean annual evaporation from a lake is approximately 55 inches. The mean annual evaporation measured in a weather bureau pan is approximately 79 inches.

The average annual wind velocity is light. In spring a fairly strong wind may blow for several days from the west or southwest. This wind usually coincides with the duststorms of west Texas. Cold masses of air, called "northers" in the Great Plains, move into the area from the north and bring a sudden drop in temperature. This drop hinders farm operations when the temperature falls

[3] ROBERT B. ORTON, State climatologist, United States Weather Bureau, provided the data for this section.

TABLE 6.—*Normal monthly and annual temperatures and precipitation at Waxahachie, Ellis County, Texas*

[Elevation, 540 feet]

Month	Temperature [1]			Precipitation [1]		
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1954)	Wettest year (1957)
				Inches	*Inches*	*Inches*
January	46. 0	85	−1	2. 47	2. 20	1. 41
February	49. 0	88	2	3. 10	. 83	2. 49
March	55. 8	96	7	2. 49	. 63	3. 49
April	64. 7	97	30	3. 71	2. 52	12. 31
May	72. 9	101	38	4. 97	2. 25	11. 20
June	81. 4	106	50	3. 31	. 55	2. 34
July	85. 1	111	60	2. 25	. 78	. 50
August	85. 1	114	56	1. 44	1. 07	. 62
September	78. 2	108	37	2. 57	4. 86	3. 39
October	68. 6	101	27	2. 90	2. 95	7. 94
November	55. 5	91	17	3. 24	2. 76	6. 72
December	48. 3	87	8	2. 66	. 54	2. 41
Year	65. 9	114	−1	35. 11	21. 94	54. 82

[1] Temperature and precipitation based on 31-year record, through 1961.

below freezing. Occasionally the temperature drops as low as 10° F. A record low temperature of 9° occurred in February 1899.

The average annual snowfall for the area is less than 1 inch. The heaviest snowfall usually stays on the ground less than a week, and in many winters the snow is not measurable.

Hailstorms may occur in spring, but they are not widespread. Damage in the county from hail usually is only in small local areas.

The mean annual temperature at Waxahachie is 66°, and the average length of the freeze-free season is 243 days. On the average there are 275 days between the last 28° temperature in the spring and the first in the fall.

The growing season is long enough for all general field crops to mature, and the winters are mild enough for cool-season plants to grow. A dry fall sometimes prevents cool-season crops from making a stand full enough to provide cover for the cultivated land or for grazing in pastures.

The first freeze in the fall usually occurs about November 18, but it has occurred as early as October 27 and as late as December 27. The last freeze in the spring occurs about March 20. It has occurred as early as February 14 and as late as April 15. Chances are 1 to 5 that a temperature of 32° will occur after March 30 and before November 8. Chances are 1 to 20 that there will be a temperature of 32° after April 13 and before October 30.

Days of sunshine range from about 78 percent in July to about 47 percent in January.

Flood Prevention

Floods are controlled by floodwater-retarding dams that are constructed in the watershed near the head of streams. These structures are designed to fit the needs of the streams. They hold back the rainfall on the local watersheds and prevent flooding downstream.

Flood prevention is a joint project of the local landowners, the Soil Conservation Service and soil conservation districts, and the county commissioners. It is coordinated with the plans of the Army Corps of Engineers for flood control along major rivers. This work is authorized by Public Law 534, which was passed by the Congress in 1944.

Flood prevention work is provided for in Ellis County by the plan for flood control on the Trinity River watershed. To make planning and construction convenient, the county is divided into six subwatersheds. These are Chambers Creek, Richland Creek, Mountain Creek, Tenmile Creek, Red Oak Creek, and Village-Walker Creek.

Landowners participate voluntarily in flood prevention work. They provide easements that allow the construction of dams on sites selected by the Soil Conservation Service. Technicians of the Soil Conservation Service design these structures and supervise their construction. The earth moving is contracted to private contractors, who bid on contracts for construction of the projects.

These dams are equipped with a drawdown tube to control the water level in the lake. They also have an emergency spillway designed to prevent overtopping and to discharge excess water in periods of large floods. After a dam is built, it is fenced and sodded to bermudagrass to control erosion. Grazing is strictly controlled to maintain the grass.

The plans for flood prevention in Ellis County call for construction of 122 floodwater-retarding structures and the Bardwell Reservoir. The floodwater-retarding structures are to be built under the auspices of the Soil Conservation Service, and the reservoir, under the auspices of the Army Corps of Engineers.

Each floodwater-retarding structure will create a small lake. These lakes will vary in area of permanent water from 6 to 208 acres. The first of these dams was built in 1956, and by July 1, 1961, 49 had been completed. When all are completed, they will control the drainage from 234,203 acres. The lakes will have the capacity to retain 179,978 acre-feet of water when all are at spillway level. They will contain 21,183 acre-feet of permanent water.

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Glossary

Aggregate. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

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 reduced.

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Chalk. A soft, white or light-gray, unindurated limestone consisting principally of skeletons of *Foraminifera* in a matrix of finely crystalline calcite.

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; clay coat; clay skin.

Climax (ecology). The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Concretions. Hard grains, pellets, or nodules of various size, shape, and color consisting of concentrations of compounds that cement the soil grains together. The composition of some concretions is unlike that of the sourrounding 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; soil will not hold together in a mass.

Friable. When moist, soil crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed into a lump.

Firm. When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, soil is 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, soil adheres to other material; tends to stretch and pull apart, rather than to pull free from other material.

Hard. When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, soil breaks into powder or individual grains under slight pressure.

Cemented. Soil is hard and brittle; little affected by moistening.

Detention dam. A dam for temporary storage of streamflow or surface runoff; the stored water can be released at controlled rates.

Dispersion, soil. Deflocculation of the soil and its suspension in water.

Fissure. An extensive crack, break, or fracture in rocks.

Flagstone. A rock that splits readily into slabs suitable for flagging.

Friability. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

Geode. Hollow, globular bodies that vary from an inch to a foot or more in size; occur in certain limestone beds, but rarely found in shale.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with characteristics produced by soil-forming processes.

Horizon A. The master horizon consisting of (1) one or more mineral horizons of maximum organic accumulation; or (2) surface or subsurface horizons that are lighter in color than the underlying horizon and that have lost clay minerals, iron, and aluminum with resultant concentration of the more resistant minerals; or (3) horizons belonging to both of these categories.

Horizon B. The master horizon of altered material characterized by (1) an accumulation of clay, iron, or aluminum and of accessory organic material; or (2) blocky or prismatic structure together with other characteristics, such as stronger colors, unlike those of the A horizons or the underlying horizons of nearly unchanged material; or (3) characteristics of both these categories. Commonly, the lower limit of the B horizon corresponds to the lower limit of the solum.

Horizon C. A layer of unconsolidated material that has been affected little by organisms and is thought to be similar in chemical, physical, and mineralogical composition to the material from which at least a part of the overlying solum has developed.

Horizon D. Any stratum underlying the C, or the B if no C is present, that is unlike the C, or unlike the material from which the solum has been formed.

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.

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 stands for light yellowish brown with a hue of 10YR, a value of 6, and a chroma of 4.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH. A numerical means for designating relatively weak acidity and alkalinity in soils and other things. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape.

Plastic limit. The moisture content at which a soil changes from a solid to a plastic state.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plow layer. The soil ordinarily moved in tillage.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Pore space. That fraction of the total space in a soil that is not occupied by solid particles.

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

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

Relief. The elevations or inequalities of land surface, considered collectively.

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

Sand. Individual rock or mineral fragments in soils having diameters ranging 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.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

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.

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 upon parent material as conditioned by relief over periods of time.

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 parent 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. The term is confined to geological material. Alluvium is commonly stratified, for its layers and their characteristics were inherited from the parent material and the way it was laid down. Soil layers that result from the process of soil formation are called horizons.

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 particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms rounded on the top), *blocky* (angular or subangular), and *granular*. Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus 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 or 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. (See also Clay, Sand, and Silt.) The basic textural classes, in order of their increasing proportions of fine particles are as follows: 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."

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

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

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.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 1, page 9, for the approximate acreage and proportionate extent of soils. See tables 3, 4, and 5, pages 42, 48, and 52, respectively, for information on the engineering properties of the soils]

			Capability unit		*Range site*	
Map symbol	*Mapping unit*	*Page*	*Symbol*	*Page*	*Name*	*Page*
AuB	Austin silty clay, 1 to 3 percent slopes	8	IIe-1	31	Rolling Blackland	38
AuC2	Austin silty clay, 3 to 5 percent slopes, eroded	9	IIIe-2	33	Rolling Blackland	38
AuD2	Austin silty clay, 5 to 8 percent slopes, eroded	9	IVe-1	34	Rolling Blackland	38
BaC2	Bates fine sandy loam, 3 to 5 percent slopes, eroded	10	IIIe-4	33	Grayland	39
BcE2	Bates-Lamar complex, 5 to 12 percent slopes, eroded	10	VIe-5	36	Grayland	39
BkC2	Brackett and Austin soils, 2 to 5 percent slopes, eroded	10	IVs-1	35	Chalky Ridge	39
Br	Broken alluvial land	11	VIe-4	36	Rolling Blackland	38
BtA	Burleson clay, terrace, 0 to 1 percent slopes	12	IIs-2	32	Grayland	39
BtB	Burleson clay, terrace, 1 to 3 percent slopes	12	IIIe-1	33	Grayland	39
BuA	Burleson clay, 0 to 1 percent slopes	11	IIs-2	32	Grayland	39
BuB	Burleson clay, 1 to 3 percent slopes	11	IIIe-1	33	Grayland	39
By	Burleson clay, depressional	11	IIIw-1	34	Grayland	39
Cp	Clay pits	12	----	----	----	----
CrC2	Crockett soils, 2 to 5 percent slopes, eroded	12	IVe-2	35	Grayland	39
CrD3	Crockett soils, 3 to 8 percent slopes, severely eroded	12	VIe-5	36	Grayland	39
DsB	Dougherty and Stidham loamy fine sands, 0 to 3 percent slopes	13	IIe-3	32	Grayland	39
EcB	Eddy gravelly clay loam, 1 to 3 percent slopes	14	IVs-1	35	Chalky Ridge	39
EdD2	Eddy soils, 3 to 8 percent slopes, eroded	14	VIe-3	36	Chalky Ridge	39
EdF	Eddy soils, 8 to 20 percent slopes	14	VIIe-1	36	Chalky Ridge	39
EhC2	Ellis and Houston clays, 3 to 5 percent slopes, eroded	15	IVe-3	35	Shaly Hardland	39
EhE3	Ellis and Houston clays, 5 to 12 percent slopes, severely eroded	15	VIe-1	36	Shaly Hardland	39
Fl	Frio loam (0 to 1 percent slopes)	15	I-1	31	Bottomland	39
Fr	Frio silty clay, frequently flooded	15	Vw-1	35	Bottomland	39
Fs	Frio silty clay, occasionally flooded	16	I-1	31	Bottomland	39
Gl	Gullied land	16	VIIe-2	37	Gullied Blackland	38
Gp	Gravel pits	16	VIIe-2	37	----	----
HaA	Houston Black clay, 0 to 1 percent slopes	18	IIs-1	32	Rolling Blackland	38
HaB	Houston Black clay, 1 to 3 percent slopes	18	IIe-2	31	Rolling Blackland	38
HbA	Houston Black clay, terrace, 0 to 1 percent slopes	19	IIs-1	32	Rolling Blackland	38
HbB	Houston Black clay, terrace, 1 to 3 percent slopes	19	IIe-2	31	Rolling Blackland	38
HcB	Houston clay, 1 to 3 percent slopes	16	IIe-2	31	Rolling Blackland	38
HcC2	Houston clay, 3 to 5 percent slopes, eroded	16	IIIe-3	33	Rolling Blackland	38
HcD2	Houston clay, 5 to 8 percent slopes, eroded	17	IVe-3	35	Rolling Blackland	38
HmB	Houston and Ellis clays, 1 to 3 percent slopes	17	IIIe-3	33	Shaly Hardland	39
HsD3	Houston-Sumter complex, 5 to 8 percent slopes, severely eroded	17	VIe-2	36	Gullied Blackland	38
HuA	Hunt clay, 0 to 1 percent slopes	20	IIs-1	32	Rolling Blackland	38
HuB	Hunt clay, 1 to 3 percent slopes	20	IIe-2	31	Rolling Blackland	38
LaC2	Lamar clay loam, 2 to 5 percent slopes, eroded	20	IVe-1	34	Rolling Blackland	38
LaE2	Lamar clay loam, 5 to 12 percent slopes, eroded	20	VIe-4	36	Rolling Blackland	38
LeA	Lewisville silty clay, 0 to 1 percent slopes	21	I-1	31	Rolling Blackland	38
LeB	Lewisville silty clay, 1 to 3 percent slopes	21	IIe-1	31	Rolling Blackland	38
LeC2	Lewisville silty clay, 3 to 5 percent slopes, eroded	21	IIIe-2	33	Rolling Blackland	38
LeD2	Lewisville silty clay, 5 to 8 percent slopes, eroded	21	IVe-1	34	Rolling Blackland	38
LsD3	Lewisville soils, 5 to 8 percent slopes, severely eroded	22	VIe-4	36	Gullied Blackland	38
LwB	Lewisville association, 1 to 3 percent slopes	21	IIe-1	31	Rolling Blackland	38
LwC2	Lewisville association, 3 to 5 percent slopes, eroded	21	IIIe-2	33	Rolling Blackland	38
LwD2	Lewisville association, 5 to 8 percent slopes, eroded	21	IVe-1	34	Rolling Blackland	38
PcA	Payne clay loam, 0 to 2 percent slopes	22	IIIe-1	33	Grayland	39
PnB	Payne and Norge soils, 1 to 3 percent slopes	22	IIIe-1	33	Grayland	39
PrA	Pratt loamy fine sand, terrace, 0 to 3 percent slopes	22	IIIs-1	34	Grayland	39
Sc	Slickspots	23	----	----	----	----
SeB2	Stephen-Eddy complex, 1 to 3 percent slopes, eroded	23	IIIe-2	33	Chalky Ridge	39
SeC2	Stephen-Eddy complex, 3 to 5 percent slopes, eroded	23	IVe-1	34	Chalky Ridge	39
StB	Stephen silty clay, 1 to 3 percent slopes	23	IIIe-2	33	Chalky Ridge	39
SuE3	Sumter clay, 5 to 12 percent slopes, severely eroded	24	VIe-2	36	Gullied Blackland	38
Tc	Trinity clay, frequently flooded	24	Vw-1	35	Bottomland	39
To	Trinity clay, occasionally flooded	24	IIs-1	32	Bottomland	39
Tr	Trinity clay, wet	24	IIIw-1	34	Bottomland	39
Ts	Trinity clay, loamy substratum	24	I-1	31	Bottomland	39
WfA	Wilson fine sandy loam, 0 to 1 percent slopes	26	IIs-2	32	Grayland	39
WfB	Wilson fine sandy loam, 1 to 3 percent slopes	26	IIIe-1	33	Grayland	39
WsA	Wilson clay loam, 0 to 1 percent slopes	25	IIs-2	32	Grayland	39
WsB	Wilson clay loam, 1 to 3 percent slopes	25	IIIe-1	33	Grayland	39
WsB2	Wilson clay loam, 1 to 3 percent slopes, eroded	25	IVe-2	35	Grayland	39
WtA	Wilson clay loam, terrace, 0 to 1 percent slopes	26	IIs-2	32	Grayland	39
WtB	Wilson clay loam, terrace, 1 to 3 percent slopes	26	IIIe-1	33	Grayland	39

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