Series 1959, No. 6

Issued February 1962

SOIL SURVEY

Terry County Texas

OUR SOIL • OUR STRENGTH

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 Terry County will serve several groups of readers. It will help farmers 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; serve as a reference for students and teachers; and add to the knowledge of soil scientists.

In making this survey, soil scientists looked at the fields and native grasslands in all parts of the county. They dug holes and examined surface soils and subsoils; measured slopes with a hand level; noted differences in the growth of crops, weeds, and grass; and recorded the things about the soils that they believed might affect their suitability for farming, engineering, and other uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, roads, and many other landmarks can be seen on the map. The scientists also talked with farmers and others who work with soils to obtain information that would help them suggest use and management for the soils.

Locating the soils

Use the index to map sheets to locate your farm or any other area on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show the part of the county covered by each sheet of the large map.

When you have found the map sheet for your farm, you will notice that boundaries of the soils have been outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map.

Suppose, for example, an area located on the map has the symbol AfA. The legend for the detailed map shows that this symbol identifies Amarillo fine sandy loam, 0 to 1 percent slopes.

Learn about the soils

Amarillo fine sandy loam, 0 to 1 percent slopes, and all other soils in the county are described in the subsection "Descriptions of Soils." With the help of farmers and many other people, scientists placed each soil in a capability unit. A capability unit is a group of similar soils that need and respond to about the same kind of management.

Amarillo fine sandy loam, 0 to 1 percent slopes, is placed in capability unit IIIe-2 for dryland farming, and in capability unit IIe-2 for irrigated farming. Turn to the section "Use and Management of Soils," and read what is said about the soils in these capability units. The table of estimated yields tells how much you can expect to harvest from Amarillo fine sandy loam, 0 to 1 percent slopes, under two levels of management.

At the back of this report is a "Guide for Mapping Units." This guide will lead you to practically everything that is written in the report about each soil. The guide lists all soils in the county according to the alphabetic order of the map symbols. For each soil it gives the page where the soil is described. It also lists, for each soil, the pages on which are discussed the dryland capability unit, the irrigated capability unit, and the range site. A headnote leads you to the table of estimated yields, the acreage table, and the engineering section.

Make a farm plan

For the soils on your farm, compare your yields and farm practices with those given in this report. Look at your fields for signs of wind and water erosion. Look at the grasses in your pastures. Then decide whether or not you need to change your methods of farming or of managing your grassland. The choice, of course, must be yours. This survey will aid you in planning new methods, but it is not a plan of management for your farm or any farm in the county.

If you find that you need help in farm planning, consult the local representatives of the Soil Conservation Service or the county agricultural agent. Members of the staff of your State experiment station and others familiar with farming in your county will also be glad to help you.

Information for many users

This report has special sections for different groups, as well as sections that may be of value to all.

Newcomers in Terry County will be especially interested in the section "General Soil Map," which describes the broad pattern of the soils. They will find additional information about the county in the section "General Nature of the Area."

Engineers will want to refer to the subsection "Engineering Description of Soils." Tables in that section show characteristics of the soils that affect engineering.

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

Ranchers should read the section "Use and Management of Rangeland."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending upon their particular interest.

* * * * *

This soil survey was made as a part of the technical assistance furnished by the Soil Conservation Service to the Terry County Soil Conservation District. Fieldwork for the survey was completed in 1958. Unless otherwise indicated, all statements in the report refer to conditions in the county at the time the fieldwork was in progress.

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SOIL SURVEY OF TERRY COUNTY, TEXAS

SOILS SURVEYED BY WILLIAM M. MILLER, DUPREE SANDERS, MARVIN J. WHITMIRE, PAUL M. BODEN, J. DEWAYNE McANDREWS, AND HAROLD W. HYDE, SOIL CONSERVATION SERVICE

REPORT BY DUPREE SANDERS

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

TERRY COUNTY is in the extreme southern part of the High Plains, which form part of the Great Plains (fig. 1). Brownfield, the county seat, is on U.S. Highway No. 380, about 45 miles east of the Texas-New Mexico State line. The county is square, about 30 miles on a side, and covers approximately 574,720 acres.

Growth and development of the county have been based almost entirely on agriculture. In the past 50 years huge cattle ranches have been broken up and put to more intensive use by farmers. Cotton and grain sorghum are the principal crops.

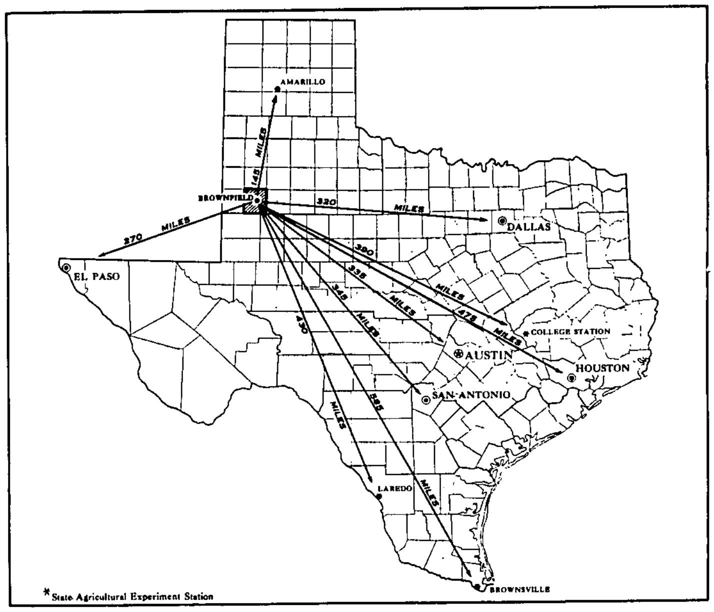

Figure 1.—Location of Terry County in Texas.

Soils in Terry County

This section consists of three main parts. The first part describes general soil areas, or soil associations, in the county; the second part describes the individual soils; and the third part discusses the effects of wind erosion.

General Soil Map

Figure 2 is a general soil map of Terry County that shows, by shading, the areas, or main soil patterns in the county. These general soil areas, or patterns of soils, are sometimes called soil associations. A knowledge of these soil areas is useful to those who want only general ideas about the soils, or wish to compare different parts of the county, or want to locate large areas that are suitable for some broad land use.

The deep sandy soils are in the extreme northwestern part of the county at the highest elevations. Soils of the sandy land are scattered throughout the county but are principally in the southern two-thirds. The soils of the mixed land (fine sandy loams) are also scattered throughout the county but are chiefly in the central and northeastern parts. Large areas of limy soils are adjacent to or are in the vicinity of the three large salt lakes in the eastern part of the county. The hard land (chiefly loams) makes up the least extensive general soil area; it is mostly in the north-central part of the county along the county line.

Table 1 lists, for each general soil area, the approximate acreage in dry cropland, in irrigated cropland, and in rangeland, as well as the total acreage. The general soil areas in the county are discussed in the following pages.

Deep sand: Brownfield-Tivoli area

This general soil area consists chiefly of Brownfield and Tivoli fine sands. It occupies approximately 18,000 acres on the higher elevations in the northwestern part of the county. The soils are on nearly level to gently sloping plains and on strongly sloping stabilized dunes.

The Tivoli soils are on the dunes. These soils consist of loose sand that extends for a depth of many feet. They are very susceptible to wind erosion. The Brownfield soils are on gently sloping to nearly level plains and are intermingled with the Tivoli soils.

All of this general soil area is rangeland. Its cover consists of a thick stand of shin oak and sand sage, as well as sand bluestem and other tall grasses. If this cover is reduced or destroyed, the soils are highly susceptible to

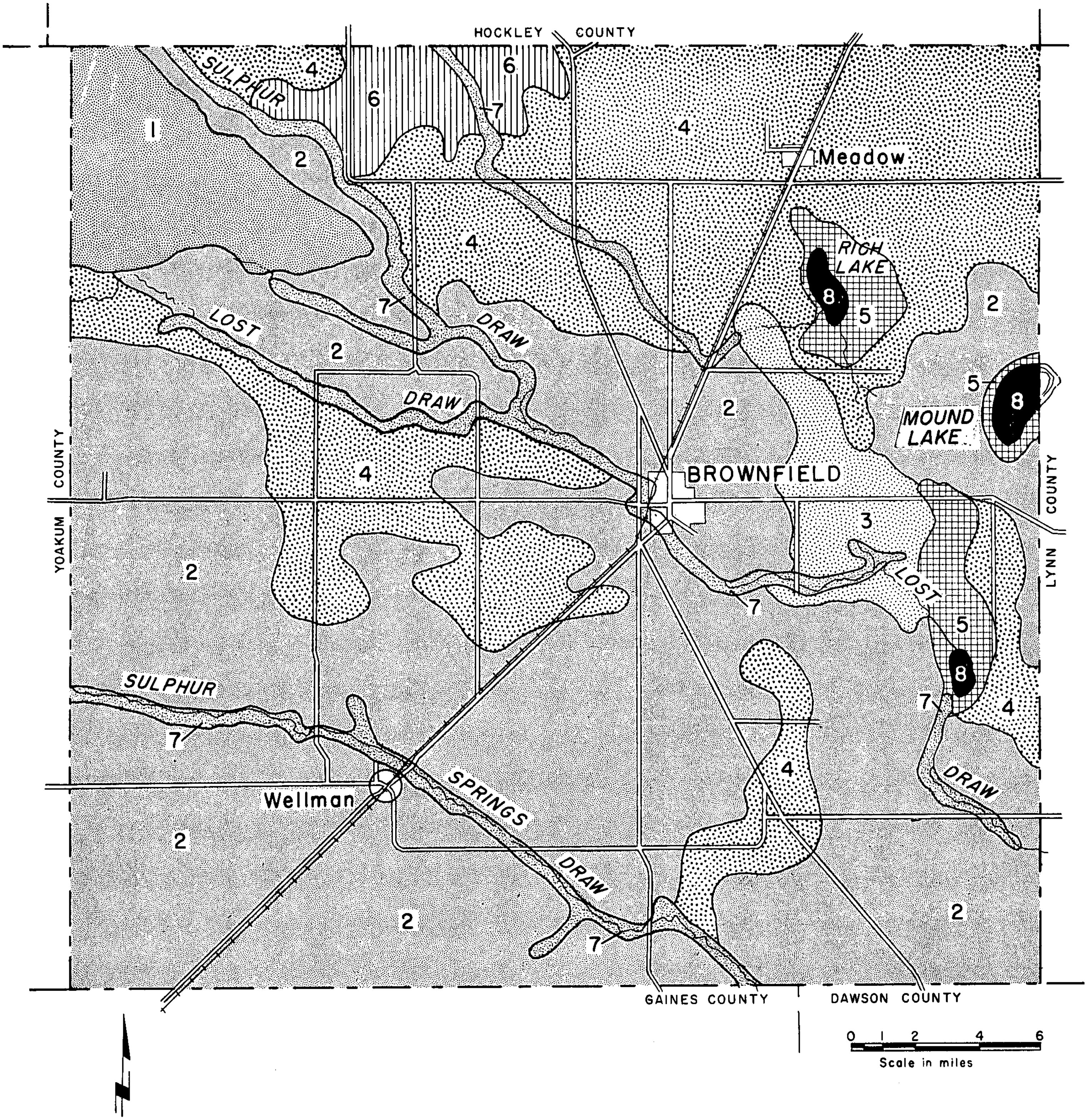

Figure 2.—General Soil Areas: (1) Deep sand: Brownfield-Tivoli; (2) Sandy land: Amarillo-Brownfield; (3) Sandy land, shallow: Brownfield-Amarillo; (4) Mixed land: Amarillo; (5) Limy soils: Portales-Drake; (6) Hard land: Amarillo-Portales; (7) Shallow land: Mansker-Potter. Salt lakes are shown in solid black (8).

TABLE 1.—*Acreage according to land use and total acreage of each general soil area in Terry County, Tex.*

General soil areas	Cropland		Range and pasture	Total area
	Dry-land	Irri-gated		
	Acres	*Acres*	*Acres*	*Acres*
Deep sand: Brownfield-Tivoli area			18, 820	18, 820
Sandy land: Amarillo-Brownfield area	190, 122	73, 133	29, 239	292, 494
Sandy land, shallow: Brownfield-Amarillo area	14, 917	785	1, 745	17, 447
Mixed land: Amarillo area	105, 719	56, 385	14, 095	176, 199
Limy soils: Portales-Drake area	23, 590	3, 932	11, 795	39, 317
Hard land: Amarillo-Portales area	4, 377	354	7, 099	11, 830
Shallow land: Mansker-Potter area	6, 492	1, 665	8, 490	16, 647
Totals	345, 217	136, 254	91, 283	[1] 572, 754

[1] The salt lakes in the county occupy an additional 1,966 acres, and the total area in the county is 574,720 acres.

wind erosion. This general soil area is not suited to cultivation, and most of it makes up parts of large ranches.

Sandy land: Amarillo-Brownfield area

This general soil area consists mainly of Amarillo and Brownfield soils. It makes up more than 50 percent of the county, chiefly in the southern two-thirds. The soils are mainly loamy fine sands and fine sands that are gently sloping or nearly level to undulating.

The Amarillo soils are the most extensive in this association. They are browner and less sandy in the surface layer than the Brownfield soils. Brownfield soils have a light-colored, loose, sandy surface layer and a reddish sandy clay loam subsoil.

Approximately 90 percent of this general soil area is cultivated; the rest is rangeland. The main crops are grain sorghum and cotton. About 73,000 acres, or 25 percent of the cultivated area, is irrigated by sprinklers, which are supplied water from wells that yield 200 to 800 gallons per minute. The rangeland is in poor to fair condition. Its vegetation is mainly shin oak but includes some little bluestem, sand dropseed, and other mid grasses.

Sandy land, shallow: Brownfield-Amarillo area

This general soil area consists mainly of shallow Brownfield soils and Amarillo soils. It occupies an area of about 17,000 acres that is a few miles east of Brownfield. The soils are mainly loamy fine sands that are gently sloping to nearly level.

The Brownfield soils are the most extensive soils in this soil association. They are moderately deep to shallow over hard caliche and make up most of this area. The Amarillo soils are deep. They have a fairly loose, sandy surface layer and a sandy clay loam subsoil.

About 90 percent of this soil area is cultivated; the rest is rangeland. Most of the cultivated area consists of the moderately deep Brownfield soils and the Amarillo soils. The main crops are grain sorghum and cotton. About

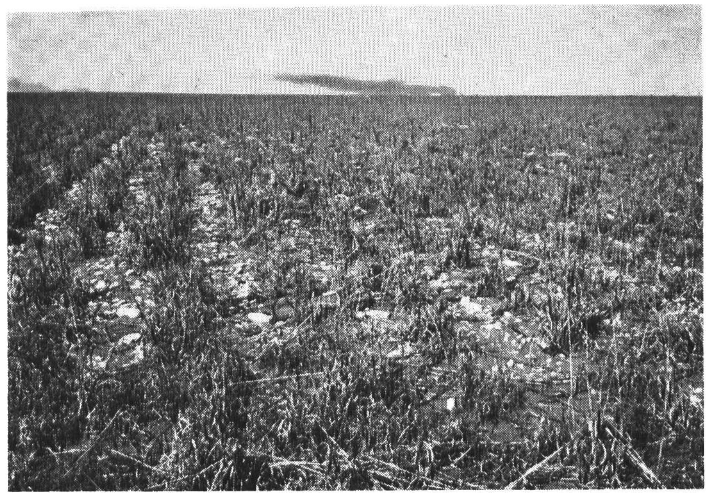

Figure 3.—Typical area of Sandy land, shallow. This field of old sorghum has been seeded to grass.

2,000 acres of the shallow Brownfield soils that has been cultivated is now seeded to perennial grasses (fig. 3). About 5 percent of the cultivated land is irrigated with sprinklers, which are supplied water from wells that yield 200 to 400 gallons per minute. The rangeland is in poor to fair condition. The vegetation is mainly shin oak but includes some sand dropseed and three-awn.

Mixed land: Amarillo area

This general soil area consists mainly of Amarillo fine sandy loam and some Arvana fine sandy loam (fig. 4). It makes up about 30 percent of the county. It is on a broad, nearly level to gently sloping plain that is mostly in the northern part. In this soil area are playas, or intermittent lakes, 2 to 40 acres in size.

About 95 percent of this soil area consists of Amarillo soils that are very productive. The Arvana soils are on small ridges within larger areas of Amarillo soils and along the slopes of Sulphur Draw and Lost Draw. They are of medium depth.

About 92 percent of this soil area is cultivated, mainly to cotton and grain sorghum. About 32 percent

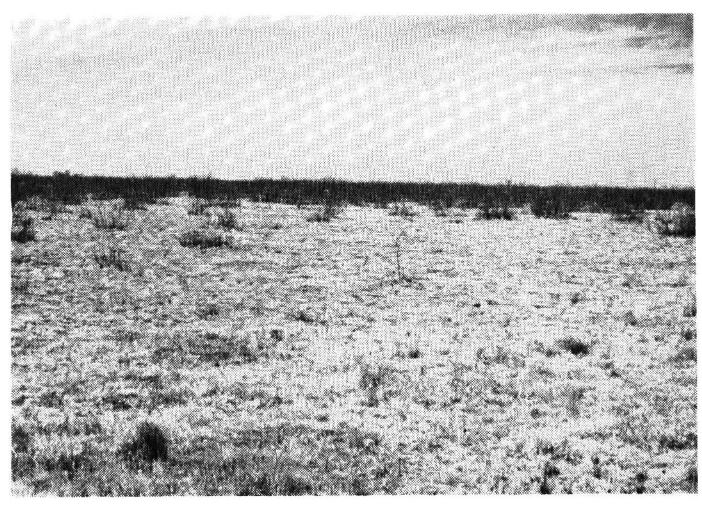

Figure 4.—Area of Mixed land. Very little of this land remains in range.

of the area is irrigated by sprinklers. The water is supplied from wells that yield 200 to 500 gallons per minute.

The rangeland in this soil area supports a moderate stand of blue grama, three-awn, and some side-oats grama. Most of it has been invaded by mesquite brush.

Limy soils: Portales-Drake area

This general soil area surrounds the three large salt lakes in the eastern part of Terry County. This consists mainly of Portales and Arch soils in low positions, on slopes of less then 3 percent. It occupies about 39,000 acres. The Portales soils are the most extensive. They are darker than the Arch soils and contain less free lime. The Drake soils are on stabilized dunes on the eastern side of the playas and are on steep slopes that border the salt lakes.

About 70 percent of this area is cultivated. Cotton and grain sorghum are the main crops. The remaining 30 percent is rangeland, which is in poor to fair condition.

Hard land: Amarillo-Portales area

This general soil area occupies approximately 12,000 acres, mostly in the north-central part of the county along the county line.

Most of this soil area consists of Amarillo loams, which are on broad, nearly level to gently sloping plains. The Portales soils are in the more sloping areas of these plains and are on flats below the Amarillo soils. Playas that range from 10 to 20 acres in size dot the landscape. On the floors of these playas are clayey Randall soils.

About 40 percent of this soil area is cultivated. Cotton and grain sorghum are the main crops, and little water is available for irrigation. The remaining 60 percent of the area is rangeland, still in native plants. The native plants, on ranges that are in fair to good condition, are buffalograss, blue grama, black grama, and some side-oats grama.

Shallow land: Mansker-Potter area

This general soil area occupies about 16,000 acres. Most of this acreage is along the slopes of Lost Draw, Sulphur Draw, and other ancient drainageways that cross the county in a northwest to southeast direction.

Most of this soil area consists of gently to strongly sloping Mansker fine sandy loams, which are on the sides of the draws and surround areas of Potter soils. The Potter soils are very shallow and, in most places, occupy small areas.

About 49 percent of this general soil area is cultivated along with surrounding areas. The remaining 51 percent is native rangeland, which is in poor to fair condition.

Salt lakes

The salt lakes in Terry County are Rich Lake, Mound Lake, and an intermittent smaller lake that is about 11 miles southeast of Brownfield (fig. 5). The size of these lakes varies according to the amount of rainfall. The largest occupies about 1,300 acres. In periods of normal rainfall, the combined area of the salt lakes is 1,966 acres. The lake bottoms are strongly affected by soluble salts. Consequently, they cannot be used for agricultural purposes. Cretaceous outcroppings occur in places surrounding Rich and Mound Lakes.

Figure 5.—Salt lake in Terry County.

Descriptions of Soils

This subsection provides detailed information about the soils of Terry County. It describes the soil series, or groups of soils that are essentially the same in kind of parent material and other natural characteristics, and the single soils, or mapping units, that are shown on the detailed map at the back of this report.

Soil series are generally named for the places where they were first mapped, and in this report are arranged in alphabetic order. Each soil series is described briefly, and then the single soils, or mapping units, in that series are described. A mapping unit is one area or more on the ground, identified by a given symbol on the soil map. Normally, a mapping unit is a member of a soil series, but it may also be two or more kinds of soil in areas too small to separate on the map (soil complex); or several soils recognized as different but, for practical reasons of management, not enough different to be separated (undifferentiated soil group).

In most instances, however, a mapping unit is a member of a soil series and is either a soil type or a soil phase. A soil type is a subdivision of the soil series that is separated on basis of the texture of the surface layer. All the soils of a given series that have the same texture in the surface layer belong to the same soil type; for example, Arch loam. A soil phase is a subdivision of the soil type that is made to designate slope, erosion, stoniness, or some other characteristic that affects use and management; for example, Amarillo fine sandy loam, 0 to 1 percent slopes.

In this section, you can gain a working knowledge of each mapping unit by reading only the larger print. If you want detailed information, read the smaller print, in which you will find a detailed description of the soil. Some of the terms used in recording the properties of a soil profile may not be familiar and, therefore, are explained.

SOIL TERMS

Soil scientists call the upper part of a soil the *A horizon*. This term refers to the layer or layers that have lost some of the clay and other soluble minerals. Water has leached these out and carried them to the horizon below. The A horizon may be divided into A_1, A_2, and A_3 horizons.

The *B horizon* is the layer or layers in which some of the clays and minerals leached from the A horizon have accumulated. This horizon is sometimes divided into B_1, B_2, and B_3 horizons. The B horizon is frequently referred to as *subsoil.*

Below the B horizon in many soils there is a *C horizon,* or parent material. A C_{ca} horizon has formed in the upper part of the C horizon in many soils that have developed from material containing free lime.

The *D horizon* consists of material that does not conform with the material in the overlying horizons. The Arvana soils and some Spur soils in this county have a D horizon; normally it is a deposit of limy material called *caliche.*

The color of a soil horizon is denoted by words, such as "grayish brown," and by Munsell notations, such as "10YR 5/2." Munsell notations indicate color more precisely than words and are used mainly by soil scientists and others who must make detailed comparisons of soils. In this report, the color given in words is the color of the soil when dry, but the Munsell notation that follows gives the color when both dry and moist (*7*).[1]

The *texture* of a soil is judged in the field by moistening a sample and rubbing it between the fingers, and later may be verified by analyses in the laboratory. The texture of a soil is determined by the proportions of sand, silt, and clay. A fine sand is at least 85 percent sand; it is loose and friable when wet or dry. A clay is never more than 45 percent sand and is always more than 35 percent clay; it is sticky and plastic when wet and hard when dry. Between sand and clay, there are other textures, for example, *clay loam, fine sandy loam, sandy clay loam.*

The *structure* of a soil is the arrangement of the soil grains into aggregates, and the distinctness, size, and shape of these. Terms for distinctness are *weak, moderate,* and *strong;* for size, *very fine, fine, medium, coarse,* and *very coarse;* and for shape, *prismatic, blocky, subangular blocky,* and *granular.* Soils without structure are described as *structureless* if they are sands, or as *massive* if they are clays.

The *consistence* of a soil is the tendency of the particles to stick together, or cohere, when wet, moist, and dry. Some common terms for consistence are *sticky when wet, friable when moist,* and *hard when dry.*

Other characteristics of the soil horizons, such as the amount of pores, clay films, and insect activity, are also described. The presence of free lime is indicated by the word "calcareous."

OTHER INFORMATION

On reading about each mapping unit you will find statements about its use and management, and a reference showing in which capability unit and range site the mapping unit has been placed. Capability units are discussed in the section "Use and Management of Soils," and range sites, in the section "Use and Management of Rangelands." The approximate acreage of each soil is given in table 2.

Amarillo series

In this series are deep, well-developed, moderately sandy soils that have a reddish color. These soils have developed on soft, calcareous, alluvial or eolian parent materials. They contain an accumulation of calcium carbonate, or lime, below a depth of 36 inches.

Amarillo soils have smooth, nearly level to gentle, convex slopes. They are associated with Arvana, Brownfield, Portales, and Zita soils. They are lower lying, less sandy, and less red than the Brownfield soils, which normally do not have a layer of calcium carbonate. Amarillo soils are in slightly higher areas than the calcareous, more nearly level Portales soils and the dark-colored, more nearly level Zita soils.

Amarillo fine sandy loam, 0 to 1 percent slopes (AfA).—This soil has a reddish-brown surface layer, 8 to 14 inches thick. Its subsoil is reddish-brown to dark-brown sandy clay loam, 24 to 48 inches thick. The subsoil is underlain by soft, pink caliche at depths of 36 to 72 inches.

Where used as rangeland, this soil has a cover of blue grama, side-oats grama, and some buffalograss. Catclaw and mesquite are invading shrubs, but there is no shin oak.

This soil is associated in the county with other Amarillo soils. Where it is associated with Amarillo loams, it is on the higher lying ridges and slopes. Where it is associated with Amarillo loamy fine sand, 0 to 3 percent slopes, it lies on the lower lying flats and gentle slopes.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Amarillo fine sandy loam, 0 to 1 percent slopes	112, 386	19. 6
Amarillo fine sandy loam, 1 to 3 percent slopes	42, 785	7. 4
Amarillo fine sandy loam, 3 to 5 percent slopes	605	. 1
Amarillo loam, 0 to 1 percent slopes	5, 836	1. 0
Amarillo loam, 1 to 2 percent slopes	527	. 1
Amarillo loamy fine sand, 0 to 3 percent slopes	156, 280	27. 2
Arch loam	932	. 2
Arvana fine sandy loam, 0 to 1 percent slopes	2, 801	. 5
Arvana fine sandy loam, 1 to 3 percent slopes	964	. 2
Arvana fine sandy loam, shallow, 0 to 3 percent slopes	1, 612	. 3
Arvana-Potter complex	645	. 1
Brownfield fine sand, thick surface	21, 285	3. 7
Brownfield fine sand, thin surface	111, 377	19. 4
Brownfield soils, moderately shallow	22, 014	3. 8
Brownfield soils, shallow	2, 806	. 5
Brownfield soils, severely eroded	2, 205	. 4
Drake soils, 1 to 3 percent slopes	3, 046	. 5
Drake soils, 3 to 5 percent slopes	2, 325	. 4
Drake soils, 5 to 30 percent slopes	856	. 1
Gomez and Arch soils	4, 493	. 8
Mansker fine sandy loam, 0 to 1 percent slopes	1, 940	. 3
Mansker fine sandy loam, 1 to 3 percent slopes	4, 196	. 7
Mansker fine sandy loam, 3 to 5 percent slopes	5, 256	. 9
Mansker loam, 0 to 1 percent slopes	469	. 1
Mansker loam, 1 to 3 percent slopes	519	. 1
Mansker-Potter complex	2, 697	. 5
Portales fine sandy loam, 0 to 1 percent slopes	22, 151	3. 9
Portales fine sandy loam, 1 to 3 percent slopes	10, 007	1. 7
Portales loam, 0 to 1 percent slopes	3, 259	. 6
Potter soils	925	. 2
Randall clay	2, 208	. 4
Randall fine sandy loam	1, 419	. 2
Spur clay loam	947	. 2
Spur fine sandy loam	2, 290	. 4
Spur loamy fine sand	3, 041	. 5
Tivoli fine sand	8, 271	1. 4
Zita fine sandy loam, 0 to 1 percent slopes	7, 379	1. 3
Salt Lakes	1, 966	. 3
Total	574, 720	100. 0

[1] Italic numbers in parentheses refer to Literature Cited, page 57.

Amarillo fine sandy loam, 0 to 1 percent slopes, was the favorite soil of the first farmers in the area and has been cultivated longer than many other soils. Consequently, many areas have been winnowed by wind to the extent that much of the clay and silt in the plow layer has blown away. The top 3 to 6 inches of this soil is much coarser textured than it used to be.

Representative profile:

Location: 0.5 mile south and 0.9 mile west of the northeast corner of section 6, block D–8, E. L. and R. R. RR. Co. survey.

A_p 0 to 10 inches, reddish-brown (5YR 4/4; 3/4, moist) fine sandy loam; structureless; few fine roots; few lenses of loamy fine sand; few clods of sandy clay loam; noncalcareous; abrupt boundary.

B_{21} 10 to 23 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; many very fine tubes and pores; many insect casts and burrows as much as 2 millimeters in diameter; many fine roots; noncalcareous; clear boundary.

B_{22} 23 to 32 inches, yellowish-red (5YR 5/6; 4/6, moist) sandy clay loam; structure and consistence same as in B_{21} horizon; few very fine roots; many very fine tubes and pores; few insect casts and burrows as much as 1 millimeter in diameter; noncalcareous; abrupt boundary.

B_3 32 to 46 inches, reddish-yellow (5YR 6/6; 5/6, moist) sandy clay loam; weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; slightly coarser texture than in B_{22} horizon; few very fine tubes and pores; few insect casts; few very fine roots; many films and threads of calcium carbonate; strongly calcareous; clear boundary.

C_{ca} 46 to 72 inches +, pink (5YR 7/4; 6/4, moist) sandy clay loam; few very fine tubes and pores; common fragments and concretions of calcium carbonate as much as 5 millimeters in diameter; very strongly calcareous.

Range in characteristics.—The A horizon ranges from 8 inches to 14 inches in thickness. In many places wind has winnowed fine particles from the soil, leaving lenses of loamy fine sand. These lenses have been mixed with the rest of the surface soil, and the plow layer is a light fine sandy loam. The A horizon ranges from reddish brown (5YR 4/4; 3/4, moist) to brown (7.5YR 5/4; 4/4, moist).

The B_{21} horizon is reddish brown (5YR 4/4; 3/4, moist) to dark brown (7.5YR 4/4; 3/4, moist) and 10 to 14 inches thick. The B_{22} horizon is normally 1 to 2 units higher than the B_{21} horizon in value and chroma. It is 9 to 18 inches thick. The B_3 horizon, where present, ranges from red (2.5YR 5/6; 4/6, moist) to light brown (7.5YR 6/4; 5/4, moist). It is 5 to 17 inches thick and may or may not be calcareous.

The C_{ca} horizon ranges from 36 to more than 72 inches in depth. It is reddish yellow (5YR 7/6; 6/6, moist) to pink (5YR 7/4; 6/4, moist).

In most places roots are well distributed throughout the B_2 horizon. They penetrate the peds and, when they decay, leave a network of tubes and pores that aid the movement of air and water through the horizon. Faint to distinct clay films occur on some prism faces. Worm channels, cavities, and organic stains indicate that worms have been active in the B_2 horizon in most places.

The C_{ca} horizon ranges from light sandy clay loam to clay loam. In most places 10 percent to 40 percent of this horizon consists of soft and hard concretions of calcium carbonate, 5 to 20 millimeters in diameter.

The parent material is normally pinkish and weakly to strongly calcareous. It is sandy clay loam to clay loam that is friable and porous.

Inclusions.—The following, normally in areas less than 5 acres in size, may make up as much as 5 percent of each delineation of this soil:

Portales fine sandy loam, 0 to 1 percent slopes, as local calcareous spots.
Arvana fine sandy loam, 0 to 1 percent slopes on slope breaks and ridges.
Amarillo fine sandy loam, 1 to 3 percent slopes.

Use and management.—This is the most productive soil in the county for dryland farming. You can expect good yields of cotton, grain sorghum, legumes, and grass under dryland or irrigated farming. Under dry farming, commercial fertilizer has not increased yields much (*6*).

Under irrigation, yields of cotton, grain sorghum, and grass have increased where nitrogen and phosphate have been added. Where cultivated, this soil is moderately susceptible to wind erosion. If enough water is available, irrigation can be by the sprinkler, level-furrow, or level-border methods.

Capability unit: IIIe–2, dryland (IIe–2, irrigated).
Range site: Mixed Land.

Amarillo fine sandy loam, 1 to 3 percent slopes (AfB).—This soil is on ridges surrounded by large areas of Amarillo fine sandy loam, 0 to 1 percent slopes, and on slopes that border the playas. It is slightly redder than the more nearly level soil and is thinner in the surface soil. This soil is winnowed by wind and slightly eroded by water. Infrequent heavy rains have formed small shallow gullies and rills, but these are erased by normal tillage.

A typical area of this soil is 0.5 mile south and 0.43 mile west of the northeast corner of section 47, block D–11. This is about 12 miles northwest of Brownfield.

Use and management.—If you cultivate this soil, the hazard of sheet, gully, and wind erosion will be moderate. Sprinklers are generally used for irrigation because the supply of irrigation water is small and the soil is sloping.

Capability unit: IIIe–3 (dryland and irrigated).
Range site: Mixed Land.

Amarillo fine sandy loam, 3 to 5 percent slopes (AfC).—This soil is on convex slopes, generally less than 400 feet long, that run into playas and ancient drains. It is slightly redder than the more nearly level Amarillo soils and is shallower to calcareous material. This soil is highly susceptible to water erosion, but because of the short slopes, damage by water erosion is less than might be expected. Small gullies and rills are formed in cropland by heavy rains but generally can be erased by normal tillage.

A typical area of this soil is 0.58 mile south and 0.42 mile west of the northeast corner of section 3, block D–12. This is about 5½ miles west of Brownfield.

Use and management.—This soil is highly susceptible to water erosion and moderately susceptible to wind erosion. It is suited to only an occasional row crop or to sown crops or grasses.

Capability unit: IVe–1 (dryland and irrigated).
Range site: Mixed Land.

Amarillo loamy fine sand, 0 to 3 percent slopes (AmB).—This is the sandiest Amarillo soil in the county. It is on long, convex slopes that, in most places, are not steeper than 2 percent. It has a yellowish-red to brown surface soil, 10 to 20 inches thick, and a red to brown sandy clay loam subsoil, 30 to 60 inches thick. The subsoil is underlain by soft, pink caliche at depths of 4 to 6 feet.

This soil is normally in broad areas that are transitional between the Brownfield soils and the less sandy Amarillo soils. Low dunes may occur along fence rows. Native range on this soil generally has sparse stands of shinnery oak and some bushy mesquite. The present cover on most rangeland consists mainly of blue grama, three-awn, and sand dropseed. Where it occurs with Brownfield soils, this soil is normally smoother and lower lying than it is elsewhere.

Included with this soil are areas that were areas of Amarillo fine sandy loam, 0 to 1 percent slopes. These areas have had enough clay and silt blown away for the surface layer to be a loamy fine sand after it is plowed.

Representative profile:

Location: 0.4 mile west of the northeast corner of section 5, block T, D. and W. RR. Co. survey.

A_{1p} 0 to 7 inches, reddish-brown (5YR 5/4; 4/4, moist) loamy fine sand; structureless; nonsticky when wet, very friable when moist, and loose when dry; few very fine roots; noncalcareous; abrupt boundary.

A_1 7 to 11 inches, reddish-brown (5YR 4/3; 3/3, moist) loamy fine sand; weak, coarse, prismatic; slightly sticky when wet, friable when moist, and slightly hard when dry; few very fine roots; noncalcareous; gradual boundary.

B_{21} 11 to 21 inches, reddish-brown (5YR 4/4; 3/3, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; many very fine tubes and pores; many fine insect casts and burrows as much as 3 millimeters in diameter; few very fine roots; noncalcareous; clear boundary.

B_{22} 21 to 36 inches, reddish-brown (5YR 5/4; 4/4, moist) sandy clay loam; weak, subangular blocky; consistence same as in B_{21} horizon; few very fine tubes and pores; few insect casts and burrows as much as 2 millimeters in diameter; noncalcareous; clear boundary.

B_3 36 to 46 inches, light reddish-brown (5YR 6/4; 5/4, moist) sandy clay loam; consistence same as in B_{22} horizon; many very fine tubes and pores; few insect casts and burrows as much as 1 millimeter in diameter; many threads and films of calcium carbonate; strongly calcareous; abrupt boundary.

C_{ca} 46 to 76 inches, pinkish-white (5YR 8/2; 7/2, moist) sandy clay loam; many concretions of calcium carbonate as much as 5 millimeters in diameter; about 60 percent of horizon is pure, soft calcium carbonate; gradual boundary.

C 76 to 84 inches +, light reddish-brown (5YR 6/4; 5/4, moist) light sandy clay loam; strongly calcareous.

Range in characteristics.—The A horizon ranges from reddish brown to brown in hues of 5 to 7.5YR, value of 4 to 5, and chroma of 2 to 4. Winnowed A_p horizons that have lost much silt, clay, and organic matter may have value and chroma of 6. The A horizon ranges from 10 to 20 inches in thickness but is about 14 inches thick in most places.

The B_{21} horizon ranges from red (2.5YR 4/6; 3/6, moist) to brown (7.5YR 5/4; 4/4, moist). It is reddish brown (5YR 4/4; 3/4, moist) in most places. It is 7 to 23 inches thick. The color of the B_{22} horizon is higher in chroma and value than the B_{21} horizon in most places. This horizon ranges from 7 to 27 inches in thickness. If it occurs, the B_3 horizon is at a depth between 32 and 45 inches. It is predominantly yellowish red (5YR 5/6; 4/6, moist) and may or may not be calcareous.

Some of this soil that is associated with Arvana soils has indurated caliche at depths of 36 to 56 inches, but in most places there is no caliche to depths of 72 inches.

A distinct pale-brown to pink C_{ca} horizon normally occurs at depths of 40 to 72 inches.

Inclusions.—The following, normally in areas less than 5 acres in size, may make up as much as 5 percent of each delineation of this soil:

Amarillo fine sandy loam, 0 to 1 percent slopes.
Brownfield fine sand, thin surface.
Brownfield soils, moderately shallow.

Use and management.—This soil is fairly productive, but it needs more intensive management than the Amarillo fine sandy loams because it is more susceptible to wind erosion. The only practical way to irrigate is by sprinklers. Farmers in the area have reported good results from the use of nitrogen and phosphate fertilizers on irrigated crops.

If this soil is not protected by residue in spring when the wind blows hard, beds are likely to be leveled and furrows filled. But normal preparation of the seedbed, planting, and cultivation erase the effects of this erosion. Most of this soil has been deep plowed to depths of 14 to 20 inches. This plowing has added some clay from the B_2 horizon to the sandy surface soil, thereby making tillage to control wind erosion more effective.

Capability unit: IVe–3, dryland (IIIe–5, irrigated).

Range site: Sandy Land.

Amarillo loam, 0 to 1 percent slopes (AlA).—This soil has a reddish-brown to brown surface soil, 4 to 10 inches thick. Its subsoil is more clayey than the surface soil and contains a small amount of free lime in the lower part. The subsoil is underlain by soft caliche at depths of 30 to 48 inches.

The vegetation on rangeland is primarily blue grama and buffalograss, and there are a few small mesquite trees.

This soil has a small total acreage. It is in the north-central part of the county and locally is called hardland or tight land.

Some areas of this soil have been cultivated for a long time. These areas may have 3 to 4 inches of fine sandy loam in the plow layer. This sandy texture is a result of the wind blowing much of the silt and clay out of the plow layer.

Representative profile:

Location: 0. 09 mile west and 0. 10 mile north of the southeast corner of section 18, block D–11. This is about 14 miles northwest of Brownfield.

A_{11} 0 to 3 inches, brown (7.5YR 4/4; 3/4, moist) loam; structureless; sticky when wet, friable when moist, and slightly hard when dry; many very fine roots; few very fine tubes and pores; surface crusting is evident; noncalcareous; clear boundary.

A_{12} 3 to 8 inches, reddish-brown (5YR 4/3; 3/3, moist) loam; weak, prismatic and weak, subangular blocky; sticky when wet, firm when moist, and hard when dry; many very fine tubes and pores; many insect burrows and casts as much as 5 millimeters in diameter; many very fine roots; noncalcareous; clear boundary.

B_2 8 to 18 inches, reddish-brown (5YR 4/4; 3/4, moist) heavy sandy clay loam; moderate, medium, prismatic and weak, subangular blocky; very sticky when wet, firm when moist, and very hard when dry; many very fine tubes and pores as much as 2 millimeters in diameter; many insect casts and burrows as much as 10 millimeters in diameter; many very fine roots; noncalcareous; gradual boundary.

B_3 18 to 36 inches, brown (7.5YR 5/4; 4/4, moist) heavy sandy clay loam; weak, subangular blocky; very sticky when wet, firm when moist, and very hard when dry; few tubes and pores; few insect casts and burrows as much as 2 millimeters in diameter; few very fine roots; few fragments and concretions of calcium carbonate, as much as 1 inch in diameter, in lower part; strongly calcareous; gradual boundary.

C_{ca} 36 to 72 inches +, reddish-yellow (5YR 7/6; 6/6, moist) sandy clay loam; sticky when wet, friable when moist, and hard when dry; few very fine roots; fragments and concretions of calcium carbonate as much as 1 inch in diameter make up about 30 percent of this horizon by volume; concretions are fewer and contain slightly less calcium carbonate as depth increases; very strongly calcareous.

Range in characteristics.—The A_1 horizon ranges from 4 to 9 inches in thickness and from brown (7.5YR 4/3; 3/3, moist) to reddish brown (5YR 4/4; 3/4, moist) in color.

The B_2 horizon is 10 to 24 inches thick and brown (7.5YR 4/4; 3/4, moist) to reddish brown (5YR 4/4; 3/4, moist). The lower part of the B_2 horizon is slightly higher in chroma and value than the upper part. A strongly calcareous B_3 horizon, 8 to 20 inches thick, normally occurs. The C_{ca} horizon begins at depths of 30 to 48 inches.

Inclusions.—The following may make up as much as 10 percent of each delineation of this soil:

Small areas of soils that are similar to Portales loam, 0 to 1 percent slopes, and are calcareous throughout the profile.
Transitional areas of Amarillo fine sandy loam.

Use and management.—This soil is very productive if rainfall is adequate. In years when rainfall is above average, you can expect excellent yields of cotton, grain sorghum, grasses, and legumes. This soil, however, tends to be droughty. In years when rainfall is below average, yields are less than those on the Amarillo fine sandy loams. Under irrigation this is the most productive soil in the county. If cultivated, it is slightly susceptible to wind and water erosion. Save as much of the water that falls on this soil as you can.

Capability unit: IIIce-1, dryland (IIe-1, irrigated).
Range site: Deep Hardland.

Amarillo loam, 1 to 2 percent slopes (AlB).—This soil has short, very gently sloping, convex slopes. It occurs on ridges that are surrounded by much larger areas of Amarillo loam, 0 to 1 percent slopes, and on slopes that border playas. In many places this soil is redder throughout the profile than Amarillo loam, 0 to 1 percent slopes, and has thinner horizons. In most areas water erosion is slight.

A representative area of this soil is 0.34 mile west and 0.15 mile south of the northeast corner of section 18, block D-11.

Use and management.—If you cultivate this soil, the hazard of wind erosion will be slight and that of water erosion will be moderate. The most effective way to irrigate is by the level-border method.

Capability unit: IIIe-1 (dryland and irrigated).

Range site: Deep Hardland.

Arch series

This series consists of shallow, brown to grayish-brown, strongly calcareous soils that are on large flats or benches of the ancient playas or are in large depressions. These soils are nearly level. They have formed in old alluvium or on outwash plains that have been enriched with lime deposited by ground water or by runoff from adjacent limy areas.

Arch soils occur with Drake, Mansker, and Portales soils. They have a more uniform texture in the surface soil than the Drake soils, which are on the eastern sides of playas on hills and stabilized dunes formed by wind. They are lighter colored than the Mansker soils. Arch soils are lighter colored, more calcareous, and shallower than the Portales soils.

Arch loam (Ar).—This soil has a brown to light brownish-gray, strongly calcareous surface layer 6 to 12 inches thick. The subsoil is slightly more clayey and lighter in color than the surface soil and contains more free lime. At depths of 20 to 30 inches, the subsoil is underlain by white, very strongly calcareous, soft caliche.

In some small areas the wind has blown away much clay and silt. In these areas the texture of 2 to 4 inches of the plow layer is fine sandy loam instead of loam.

Representative profile:

Location: 0.4 mile west and 350 feet north of the southeast corner of section 3, block A-1.

A_p 0 to 10 inches, light brownish-gray (10YR 6/2; 4/2, moist) loam; structureless; sticky when wet, friable when moist, and slightly hard when dry; contains few clods from AC horizon; few very fine roots; slight surface crusting; few very fine, hard concretions of calcium carbonate on surface; strongly calcareous; abrupt boundary.

AC 10 to 14 inches, light-gray (10YR 7/2; 5/2, moist) clay loam; sticky when wet, friable when moist, and slightly hard when dry; common very fine tubes and pores; common insect casts and burrows as much as 5 millimeters in diameter; few very fine roots; strongly calcareous; clear boundary.

C_{ca1} 14 to 28 inches, light-gray (2.5Y 7/2; 6/2, moist) heavy clay loam; moderate, fine, granular; very sticky when wet, firm when moist, and hard when dry; common very fine tubes and pores; common insect casts and burrows as much as 6 millimeters in diameter; few very fine roots; very strongly calcareous; gradual boundary.

C_{ca2} 28 to 40 inches, white (2.5Y 8/2; 7/2, moist) heavy clay loam; very sticky when wet, firm when moist, and hard when dry; almost pure calcium carbonate; very strongly calcareous; clear boundary.

C 40 to 60 inches +, white (2.5Y 8/2; 7/2, moist) fine sandy loam; structureless; nonsticky when wet, very friable when moist, and loose when dry; strongly calcareous.

Range in characteristics.—The A horizon ranges from 6 to 8 inches in thickness. It is brown (10YR 5/3; 4/3, moist) to light brownish gray (10YR 6/2; 5/2, moist) and ranges from fine sandy loam to light clay loam in texture.

The AC horizon is light grayish brown (10YR 7/2; 5/2, moist) and ranges from 2 to 8 inches in thickness.

The C_{ca} horizon begins at depths of 10 to 29 inches. It is pinkish white (5YR 8/2; 7/2, moist) to light brownish gray (2.5Y 6/2; 5/2, moist).

Inclusions.—The following may make up as much as 5 percent of each delineation of this soil:

Small areas that have slopes of 1½ percent.
Small areas of Mansker loams.

Use and management.—If you irrigate and fertilize this soil, it will produce good yields of cotton. Grain sorghum, however, is susceptible to chlorosis, or yellowing of the leaves.

Because the content of lime is high in the surface layer, this soil is highly susceptible to wind erosion. The clods turned up by tillage are not stable. Control wind erosion in cultivated areas with a vegetative cover.

This soil can be irrigated by the sprinkler, level-furrow, or level-border method.

Capability unit: IVe-2, dryland (IIIe-4, irrigated).
Range site: High Lime.

Arvana series

In this series are well-developed, moderately sandy, reddish soils. These soils are underlain by hard, platy caliche at depths of 10 to 36 inches. They developed in a thin mantle of sandy windblown material that was deposited on caliche. The top of the caliche is smooth and rounded, but the bottom is concretionary, or knobby. The vegetation is mainly grama and buffalograss but includes some bluestem, dropseed, and a thin growth of catclaw, yucca, and small shrubby mesquite.

These soils occur with Amarillo, Brownfield, and Potter soils. They are shallower than the Amarillo and Brownfield soils, which are underlain by soft parent material. They are deeper than Potter soils and, in many places, surround small areas of Potter soils.

Most of the acreage in Arvana soils is planted to cotton and grain sorghum, but some of the more shallow areas are seeded to perennial grasses.

Arvana fine sandy loam, 0 to 1 percent slopes (AvA).—This soil has a dark-brown to reddish-brown surface layer, 8 to 12 inches thick. Its subsoil is dark-brown to red sandy clay loam, 10 to 30 inches thick. Hard, platy caliche underlies the subsoil at depths of 20 to 36 inches.

Where used as rangeland, this soil has a cover of blue grama, side-oats grama, and some buffalograss. Catclaw and mesquite are invading shrubs, but there is no shin oak.

Partly because they occur with the Amarillo fine sandy loams, many areas of this soil have been cultivated for a long time. Consequently, many areas have been eroded by wind to the extent that much of the clay and silt has blown away and the plow layer is coarser textured than it used to be.

Representative profile in an area that has a cover of buffalograss and a dense growth of broom snakeweed and mesquite:

Location: 0.55 mile north and 200 feet east of the southwest corner of section 146, block D–11. This is about 13 miles southwest of Brownfield.

A_1 0 to 12 inches, reddish-brown (5YR 4/4; 3/4, moist) fine sandy loam; very weak, subangular blocky; slightly sticky when wet, very friable when moist, and slightly hard when dry; many very fine tubes and pores; many very fine roots; many insect casts and burrows as much as 7 millimeters in diameter; noncalcareous; abrupt boundary.

B_{21} 12 to 22 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; many very fine tubes and pores as much as 1 millimeter in diameter; many very fine roots; many insect casts and burrows as much as 3 millimeters in diameter; noncalcareous; abrupt boundary.

B_{22} 22 to 36 inches, yellowish-red (5YR 5/6; 4/6, moist) sandy clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; many very fine tubes and pores as much as 1 millimeter in diameter; few fine roots; noncalcareous; abrupt boundary.

D 36 inches +, indurated caliche that is smooth and rounded on the surface, and concretionary below.

Range in characteristics.—The A horizon ranges from 8 to 12 inches in thickness and from reddish brown (5YR 4/4; 3/4, moist) to dark brown (7.5YR 4/4; 3/4, moist) in color.

The B_{21} horizon is about 10 inches thick and is reddish brown (5YR 4/4; 3/4, moist) to dark brown (7.5YR 4/4; 3/4, moist). The B_{22} horizon is at depths of 18 to 22 inches and is 14 inches thick.

The depth to the indurated caliche ranges from 20 to 36 inches.

Inclusions.—The following may make up as much as 5 percent of each delineation of this soil:

Arvana fine sandy loam, shallow, 0 to 3 percent slopes. Areas where the material is slightly calcareous above the indurated caliche.

Use and management.—Although this soil is productive, its water-holding capacity is low and its use, therefore, is limited. Under dryland farming the water-holding capacity is generally adequate. Under irrigation, however, the amount of irrigation water that can be applied without waste is small because of the shallow depth to hard caliche. If this soil is irrigated, cotton and grain sorghum benefit from applications of nitrogen and phosphate fertilizers. If it is cultivated, this soil is susceptible to moderate wind erosion and slight water erosion.

Capability unit: IIIe–2, dryland (IIe–2, irrigated).
Range site: Mixed Land.

***Figure 6.*—Profile of Arvana fine sandy loam, shallow, 0 to 3 percent slopes. Notice the lack of structure in the surface soil and the prisms in the subsoil.**

Arvana fine sandy loam, 1 to 3 percent slopes (AvB).—This soil is more sloping than Arvana fine sandy loam, 0 to 1 percent slopes. In most places it has slopes of about 2 percent. In some places, it is slightly thinner in the surface soil than Arvana fine sandy loam, 0 to 1 percent slopes, and is lighter colored throughout the profile.

This soil is winnowed by wind and slightly eroded by water. Infrequent heavy rains form small, shallow gullies and rills, but these are erased by tillage.

A representative area of this soil is 0.7 mile south and 0.46 mile west of the northeast corner of section 14, block DD. This is about 10 miles southwest of Brownfield.

Use and management.—If cultivated, this soil is susceptible to moderate wind and water erosion.

Capability unit: IIIe–3 (dryland and irrigated).
Range site: Mixed Land.

Arvana fine sandy loam, shallow, 0 to 3 percent slopes (AwB).—This soil is underlain by hard caliche at depths of 10 to 20 inches. In most places it is more sloping than Arvana fine sandy loam, 0 to 1 percent slopes. It occurs on slight ridges within large areas of Arvana fine sandy loam, 0 to 1 percent slopes, or in areas between that soil and the Arvana-Potter complex. Figure 6 shows a profile of this soil.

A representative area is 0.70 mile west and 0.20 mile south of the northeast corner of section 21, block T. This is about 7 miles east and 3 miles south of Brownfield.

Use and management.—Because it is shallow and has low water-holding capacity, this soil is limited in its use. Some of the rain is lost in runoff, and some water passes through the cracks in the hard caliche to a depth beyond the penetration of roots. If you cultivate this soil, the hazard of both wind and water erosion will be moderate.

Capabililty unit: IVe–4, dryland (IIIe–6. irrigated).
Range site: Mixed Land.

Arvana-Potter complex (Ax).—The soils in this complex are shallow and very shallow over hard caliche. These soils have a small total acreage, which is on ridgetops or gentle slopes adjacent to well-defined draws. About 60 percent of the acreage is Arvana fine sandy loam, shallow, 0 to 3 percent slopes, and 40 percent is Potter soil with a gravelly loam surface soil on 0 to 5 percent slopes.

The Arvana soil has a reddish-brown fine sandy loam surface layer, 6 to 8 inches thick. Its reddish-brown subsoil is more clayey than the surface soil and is 4 to 12 inches thick. The subsoil is underlain by hard, stonelike caliche. The Potter soil consists of 4 to 10 inches of gravelly loam that is underlain by hard caliche. It is calcareous in some places and noncalcareous in others.

A representative area of this mapping unit is 0.75 mile south and 0.8 mile west of the northewst corner of section 60, block D–14, C. and M. RR. Co. survey.

Use and management.—Because of their shallow depth, these soils are not suited to cultivation.

Capability unit: VIe–3.
Range site: Shallow Land.

Brownfield series

In this series are loose, sandy soils that have a red, friable sandy clay loam subsoil. The parent materials are noncalcareous, light sandy clay loam to loamy fine sand that have a reddish color. These soils do not have a horizon where calcium carbonate has accumulated, but in some places the eolian parent materials were deposited on thick beds of caliche. The vegetation consists of the grasses, shrubs, and annuals that normally grow on the semiarid sandy soils in the area. It is mainly tall and mid bunchgrass, shin oak, sand sage, and some bushy mesquite.

Brownfield soils occur with Amarillo, Arvana, and Tivoli soils. They are on gently rolling slopes above the smoother Amarillo soils and below the dunelike Tivoli soils. They have a thicker, lighter colored surface soil than the Amarillo soils and a redder subsoil. Brownfield soils have a sandy clay loam subsoil instead of a fine sand subsoil like that in the Tivoli soils. Hard caliche occurs at greater depths in the Brownfield soils than in the Arvana soils.

Where cultivated, the Brownfield soils are highly susceptible to wind erosion. If the surface is not protected by vegetation, a few inches of soil material may be continually shifted by the wind. When it shifts this soil material, a small amount of silt, clay, and organic matter blows out and the soil becomes sandier and less fertile than before. Fence-row dunes as much as 10 feet high are common in large areas of Brownfield soils.

Brownfield fine sand, thin surface (Bn).—This soil has a yellowish-red to brown surface layer 12 to 16 inches thick. The subsoil is red to reddish-brown sandy clay loam 20 to 48 inches thick. It grades to lighter colored less clayey parent material. Slopes are complex and range from 1 to 3 percent.

Representative profile:

Location: 0.55 mile east and 0.25 mile south of the northwest corner of section 19, block T.

A_p 0 to 16 inches, yellowish-red (5YR 5/6; 4/6, moist) fine sand; clods from the B_{21} horizon make up about 20 percent of this horizon; structureless; nonsticky when wet, very friable when moist, and loose when dry; few very fine roots, noncalcareous; abrupt boundary.

B_{21} 16 to 38 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few very fine tubes and pores as much as 1 millimeter in diameter; few insect casts and burrows as much as 2 millimeters in diameter; few very fine roots; noncalcareous; clear boundary.

B_{22} 38 to 48 inches, red (2.5YR 4/6; 3/6 moist) sandy clay loam; weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few very fine tubes and pores; few very fine roots; noncalcareous; clear boundary.

B_3 48 to 56 inches, red (2.5YR 5/6; 4/6, moist) sandy clay loam; lighter in texture than B_{22} horizon; sticky when wet, friable when moist, and hard when dry; few very fine tubes and pores; noncalcareous; diffuse boundary.

C 56 to 74 inches +, reddish-yellow (5YR 6/8; 5/8, moist) fine sandy loam; some thin layers of sandy clay loam; noncalcareous.

Range in characteristics.—The A horizon ranges from light brown to reddish yellow in hues of 5 and 7.5YR, value of 5 to 7, and chroma of 4 to 6. The lower value and chroma are in areas where the A_p horizon contains 4 or 5 inches of soil material from the B_{21} horizon that has been mixed into the fine sand. The A horizon ranges from 12 to 18 inches in thickness.

The B_{21} horizon ranges from red (2.5YR 5/6; 4/6, moist) to reddish brown (5YR 4/4; 3/4, moist) in color and from 10 to 28 inches in thickness. The B_{22} horizon normally has a higher value and chroma than the B_{21} horizon. It ranges from 10 to 20 inches in thickness. The B_2 horizon is generally sandy clay loam but in some areas is nearly clay.

Indurated caliche occurs at depths of 36 to 54 inches in some areas, but in most areas there is no caliche within a depth of 72 inches.

Inclusions.—The following may make up as much as 10 percent of each delineation of this soil:

- Areas 5 to 8 acres in size that have a horizon of almost pure calcium carbonate at depths of 30 to 36 inches. This horizon is probably a relict horizon of soft caliche.
- Sloping areas that have slopes as strong as 5 percent and little or no shin oak in the vegetation.
- Randall soils, in areas generally less than 2 acres in size, that have a surface soil of accumulated fine sand.
- Amarillo loamy fine sand, 0 to 3 percent slopes.
- Brownfield fine sand, thick surface.

Use and management.—If cultivated, this soil is highly susceptible to wind erosion. For several years, farmers have deep plowed and mixed some of the sandy clay loam subsoil with the fine sand surface soil. This plowing, along with other good management, helps to reduce or control wind erosion. The most efficient way to irrigate this soil is by sprinklers.

Capability unit: IVe–5, dryland (IIIe–7 irrigated).
Range site: Sandy Land.

Brownfield fine sand, thick surface (Bk).—This soil is sandier throughout the profile than Brownfield fine sand, thin surface, and is more susceptible to wind erosion. Its sandy surface layer ranges from 20 to 40 inches in thickness but, in most places, is less than 30 inches thick. This soil is nearly level to gently undulating. Its slopes are complex and range from 1 to 3 percent. It is in low-lying areas within larger areas of Brownfield fine sand, thin surface, and is between dunes in extensive areas within large areas of Tivoli soils.

Cultivated areas of this soil are likely to have a few inches of their surface soil shifted each year. This shifting may form low accumulations of soil material around crop stubble or other vegetation. It may also increase the size of the fence-row dunes, fill ditches along roads, and accumulate around farm buildings.

Representative profile:

Location: 0.22 mile west and 100 feet north of the southeast corner of section 7, block C–39, Public school land.

A_p 0 to 27 inches, yellowish-red (5YR 5/6; 4/6, moist) fine sand; structureless; nonsticky when wet, very friable when moist, and loose when dry; few very fine roots; few clods from B_{21} horizon on surface and scattered throughout horizon; noncalcareous; abrupt boundary.

B_{21} 27 to 34 inches, yellowish-red (5YR 5/6; 4/6, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few very fine tubes and pores; few very fine roots that do not penetrate peds; clay films on face of peds; noncalcareous; clear boundary.

B_{22} 34 to 52 inches, reddish-yellow (5YR 6/6; 5/6, moist) sandy clay loam; lighter in texture than B_{21} horizon; weak, subangular blocky; sticky when wet, friable when miost, and hard when dry; few very fine tubes and pores; few very fine roots; noncalcareous; clear boundary.

C 52 to 54 inches +, reddish-yellow (5YR 7/6; 6/6, miost), light sandy clay loam; sticky when wet, friable when moist, and slightly hard when dry; noncalcareous.

Range in characteristics.—The A horizon ranges from 20 to 40 inches in thickness.

The B horizon ranges from reddish yellow (5YR 6/6; 4/6, moist) to red (2.5YR 4/6; 3/6, moist). Where this soil occurs with Tivoli soils, the B horizon is more yellow than red and in many places is only 8 to 16 inches thick.

The C horizon ranges from fine sandy loam to light sandy clay loam.

Inclusions.—The following may make up as much as 10 percent of each delineation of this soil.

- Brownfield fine sand, thin surface.
- Gomez soil with a loamy fine sand surface soil.
- Long, narrow ridges or slope breaks having slopes of 3 to 4 percent.
- A few small areas of Randall soils that have accumulations of fine sand more than 18 inches in depth.

Use and management.—Deep plowing is impractical because, in most places, the sand is so thick that a plow cannot bring up the clayey subsoil material and mix it with the surface soil. The only way to control wind erosion is to keep a continuous cover of growing plants or stubble on this soil. The large areas that occur with Tivoli soils in the northwestern part of the county cannot be cultivated, even if they are irrigated. The most efficient way to apply water to this soil is by sprinklers.

Capability unit: VIe–2, dryland (IVe–7, irrigated).
Range site: Sand Hill.

Brownfield soils, moderately shallow (Br).—These soils are similar to Brownfield fine sand, thin surface, but are underlain by very strongly calcareous materials at depths of 20 to 36 inches. Slopes are 1 to 3 percent.

About half of the acreage in these soils is on the top of slight ridges. These areas are between Brownfield fine sand, thin surface, and Brownfield soils, shallow. In these areas, the soil developed from a thin mantle of sandy parent material that was deposited on a relict layer of hard caliche. The rest of this soil is in nearly level to gently sloping, concave depressions. In these areas, the soft, chalky, underlying material may be a relict layer of calcium carbonate or a layer that has been enriched with lime by a fluctuating water table.

Representative profile:

Location: 0.35 mile east and 400 feet north of southwest corner of section 2, block A–1, E. L. and R. R. RR. Co. survey. This is 8½ miles east of Brownfield, on U.S. Highway No. 380.

A_p 0 to 16 inches, brown (7.5YR 5/4; 4/4, moist) loamy fine sand; structureless to very weak, subangular blocky; nonsticky when wet, very friable when moist, and soft when dry; few clods plowed into this layer from B_{21} horizon; noncalcareous; abrupt boundary.

B_{21} 16 to 24 inches, dark-brown (7.5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; common fine roots and pores; thin patchy clay films on some prism faces; noncalcareous; clear boundary.

B_{22} 24 to 28 inches, brown (10YR 5/3; 4/3, moist) sandy clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few fine roots and pores; noncalcareous; clear boundary.

C_{ca} 28 to 40 inches, light-gray (10YR 7/2; 6/2, moist) sandy clay loam; about 35 percent of horizon is soft, segregated calcium carbonate; few fine concretions; very strongly calcareous; diffuse boundary.

C 40 to 60 inches +, pink (7.5YR 7/4; 6/4, moist) light sandy clay loam; many distinct, coarse mottles of yellowish red; strongly calcareous, but on the inside the mottles are weakly calcareous.

Range in characteristics.—This soil ranges more in color of the B horizon and in kinds of underlying material than it does in other characteristics. Hues of 5YR, value of 4 to 5, and chroma of 3 to 6 are common in higher lying areas that are underlain by hard, platy caliche.

Inclusions.—The following may make up as much as 10 percent of each delineation of this soil:

- Common, small areas that are calcareous to the surface.
- Brownfield fine sand, thin surface.
- Brownfield soils, shallow.

Use and management.—These soils are cultivated in most areas. They produce fair yields but are highly susceptible to wind erosion. If these soils are not protected by crop stubble in spring when the wind blows hard, beds are likely to be leveled and furrows filled. The effects of erosion, however, are erased by normal seedbed preparation, planting, and other cultivation. These soils can be successfully irrigated by sprinklers, but the moderately shallow depths limit the amount of water they can hold that is available to plants.

Capability unit: IVe–5, dryland (IIIe–7, irrigated).
Range site: Sandy Land.

Brownfield soils, shallow (Bs).—These soils are underlain by hard caliche at depths of 10 to 20 inches. In other respects they are similar to Brownfield soils, moderately shallow. They occur in small areas within larger areas of the moderately shallow soils. In many areas where these shallow soils have been deep plowed along with the surrounding moderately shallow soils, large, flat, rocklike caliche fragments cover 10 to 30 percent of the surface. Slopes are 1 to 3 percent.

A representative area of this soil is 0.25 mile west and 450 feet south of the northeast corner of section 24, block T, D. and W. RR. Co. survey.

Use and management.—Because it is highly susceptible to wind erosion and has a low capacity to hold water and plant food, this soil is not suited to cultivated crops. It should be planted to perennial grasses.

Capability unit: VIe–3.
Range site: Shallow Land.

Brownfield soils, severely eroded (Bt3).—Areas of these soils were similar to areas of Brownfield fine sand, thin surface, before they were severely eroded by wind. All of the surface soil has been reworked by wind and completely removed in places. Blowout holes are common where the surface soil and all or part of the subsoil have been removed. Areas as much as 20 acres in size may have had all of the surface soil removed; it has been carried to the edge of the blowout hole, where it forms large dunes. These dunes may be 150 feet wide or more at the base and as much as 15 feet high. Some gullying occurs in areas that have an exposed subsoil of sandy

Figure 7.—**A typical area of Brownfield soils, severely eroded.**

clay loam. Some areas consist of blowout holes and circular dunes. These dunes make up as much as 20 percent of the area. The dunes are normally covered with shin oak and a few tall grasses. Areas that have had their surface soil removed are generally bare of vegetation except in low spots that receive more water than other places (fig. 7).

A representative area of this soil is located in the middle of the southwest quarter of section 24, block C–39, Public school land.

Use and management.—This soil is not suited to cultivation. The soil material could be leveled and redistributed, but this process would be impractical because of high cost. Establishing perennial grass is difficult, but the grass will improve the condition of the soil.

Capability unit: VIIe–3.
Range site: Sand Hill.

Drake series

In this series are light-colored, weakly developed, strongly calcareous soils that make up stabilized dunes on the eastern or lee side of playas. These soils have developed in materials that were blown from the strongly calcareous, dry playa beds. In most areas Drake soils have slopes of more than 2 percent, and in some small areas that border salt lakes they have slopes as steep as 30 percent.

These soils occur with the Arch and Portales soils. They have steeper slopes than the Arch soils and are lighter colored and more strongly calcareous than the Portales soils.

Drake soils are inextensive, except in large areas adjoining the salt lakes. Because they are in small areas, they are farmed along with adjoining soils. The steeper areas are in range. On well-managed rangeland these soils support a good cover of blue grama.

Drake soils, 1 to 3 percent slopes (DrB).—These soils have a pale-brown to brown surface layer 6 to 12 inches thick. The subsoil is slightly more clayey and lighter colored than the surface soil. To depths of many feet, these soils are strongly calcareous. They are susceptible to severe wind and water erosion. Small gullies and rills have formed. The surface has been shifted about by wind, and many areas are much sandier in the surface layer than they used to be.

Representative profile:

Location: 260 feet south and 100 feet west of the northwest corner of section 14, block C–37, Public school land. This is about 12 miles southeast of Brownfield.

A_p 0 to 9 inches, grayish-brown (10YR 5/2; 4/2, moist) light clay loam having clods from the AC_1 horizon; structureless; sticky when wet, friable when moist, and slightly hard when dry; many very fine roots and few fine roots; very strongly calcareous; abrupt boundary.

AC_1 9 to 16 inches, light brownish-gray (10YR 7/2; 6/2, moist) clay loam; weak, coarse, prismatic and fine, subangular blocky; few insect burrows and casts; few very fine roots; very strongly calcareous; clear boundary.

AC_2 16 to 31 inches, very pale brown (10YR 7/3; 6/3, moist) clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; common very fine roots; few very fine tubes and pores; very strongly calcareous; gradual boundary.

C 31 to 57 inches +, white (10YR 8/2; 7/2, moist) sandy clay loam; sticky when wet, friable when moist, and slightly hard when dry; very strongly calcareous.

Range in characteristics.—The A_p horizon ranges from 6 to 12 inches in thickness and from grayish brown (10YR 5/2; 4/2, moist) to brown (10YR 5/3; 4/3, moist) in color. It is heavy fine sandy loam to clay loam. The AC horizon ranges from 9 to 30 inches in thickness and from light brownish gray (10YR 6/2; 5/2, moist) to light gray (2.5Y 7/2; 6/2, moist) in color.

Inclusions.—The following, normally in areas less than 5 acres in size, may make up as much as 15 percent of each delineation of Drake soils, 1 to 3 percent slopes:

Drake soils, 3 to 5 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.
Mansker loam, 1 to 3 percent slopes.

Use and management.—Because they occur in small areas with less erodible, more productive soils, Drake soils, 1 to 3 percent slopes, are planted to row crops in many places. Cultivated areas are susceptible to severe wind erosion and moderate water erosion. The use of these soils is also restricted by a low available water-holding capacity and a high content of lime.

Capability unit: IVe–2, dryland (IIIe–4, irrigated). Range site: High Lime.

Drake soils, 3 to 5 percent slopes (DrC).—These soils are steeper than Drake soils, 1 to 3 percent slopes, and have a wider range in texture of the surface soil. The surface soil ranges from light clay loam to fine sandy loam. These soils contain much free lime and are highly susceptible to both wind and water erosion. Even where there is native cover, small gullies have formed. In many places these gullies follow tracks made by livestock and vehicles.

A representative area is 0.4 mile south and 100 feet west of the northwest corner of section 85, block 4-X, E. L. and R. R. RR. Co. survey.

Use and management.—The use of these soils is limited by the high content of lime and by the hazard of erosion. Perennial grass is the best use. These soils can be irrigated by sprinklers.

Capability unit: VIe–1, dryland (IVe–6, irrigated). Range site: High Lime.

Drake soils, 5 to 30 percent slopes (DrE).—These steep soils are strongly calcareous and in most places have some gullies. Practically all the acreage is on slopes that border salt lakes. The slopes range from 8 to 30 percent but are about 15 percent in most places. Many gullies have been dug by runoff from the high areas that runs down the steep slopes on its way to the lakebed. Some of these gullies are stabilized.

A representative area is 0.3 mile north of the southeast corner of section 48, block E, E. L. and R. R. RR. Co. survey. This is about 10 miles east and 2 miles north of Brownfield.

Use and management.—Because of the steep slopes, these soils can be used only as rangeland.

Capability unit: VIIe–1.
Range site: High Lime.

Gomez and Arch soils

This group of undifferentiated soils consists of sandy, brown to gray soils that developed in calcareous, sandy old alluvium, or in material deposited by wind. These soils have a sandy surface layer. Their subsoil is more clayey than the surface layer and is underlain by a distinct layer of calcium carbonate.

These soils are in depressions on concave slopes that are less than 1 percent in most places. They occur with the Portales soils, which are less sandy throughout the profile than the Gomez soils and less calcareous than the Arch soils.

The larger areas of these soils are used as rangeland. Some smaller areas are cultivated along with adjoining Portales soils. The vegetation on the rangeland consists mainly of tall and mid grasses, a moderate stand of sand sage, and, in places, low mesquite trees.

Gomez and Arch soils (Ga).—This mapping unit consists of Arch loam and a Gomez soil that has a loamy fine sand surface soil. The Arch loam is described elsewhere in this subsection.

The Gomez soil has a dark grayish-brown to pale-brown sandy surface layer, 10 to 16 inches thick. The subsoil is very pale brown to brown and is more clayey than the surface layer. This is underlain by very strongly calcareous, lighter colored parent material at depths of 20 to 40 inches.

Areas of this soil that have been cultivated for a long time have as much as 20 inches of shifting loamy sand. Many areas have been deep plowed, but the underlying materials were not stable enough to help control wind erosion. In spring when the wind blows hard, the listed furrows and nearby ditches along roads are filled with loose sand. Sand hummocks, 6 to 18 inches high, are common in the fields around weeds and crop residue.

The following describes a Gomez soil that has a loamy fine sand surface soil:

Location: 0.25 mile southwest of the northeast corner of section 26, block A–1, E. L. and R. R. RR. Co. survey. This is about 10 miles east of Brownfield on U.S. Highway 380, then 4 miles south on county road.

A_1 0 to 15 inches, grayish-brown (10YR 5/2; 4/2, moist) loamy fine sand; weak, subangular blocky and granular structure; very friable when moist and soft when dry; noncalcareous but alkaline; gradual boundary.

AC 15 to 33 inches, pale-brown (10YR 6/3; 5/3, moist) fine sandy loam; weak, prismatic and weak, subangular blocky structure; friable when moist and slightly hard when dry; many fine to medium pores; common threads of calcium carbonate in lower part; strongly calcareous; clear boundary.

C_{ca} 33 to 50 inches, white (2.5Y 8/2; 7/2, moist) light sandy clay loam; friable when moist; about 40 percent of horizon is calcium carbonate that is in soft concretions or is segregated; very strongly calcareous; diffuse boundary.

C 50 to 72 inches +, white (2.5Y 8/2; 7/2, moist) fine sandy loam; contains a few soft concretions of calcium carbonate in the upper part; more sandy and less calcareous with increasing depth; strongly calcareous.

Range in characteristics.—The dry color of the A horizon is dark grayish brown to pale brown—hue is 10YR, value is 4 to 6, and chroma is 2 to 3. The A horizon is alkaline to strongly calcareous. The AC horizon ranges from fine sandy loam to light sandy clay loam in texture and is very pale brown to brown when dry. This horizon is weakly to strongly calcareous.

The C_{ca} horizon is fine sandy loam to sandy clay loam. Calcium carbonate, segregated and in soft concretions, makes up 20 to 50 percent of this horizon. The underlying strata are noncalcareous loamy fine sand or thin layers of semi-indurated caliche.

Inclusions.—The following may make up as much as 10 percent of some delineations of Gomez and Arch soils:

- Small areas of Portales soils that have had loamy fine sand deposited on them.
- Areas of Arch soil that have had 8 to 16 inches of fine sand deposited on them.

Use and management.—Partly because they are very susceptible to wind erosion, these soils are not suited to dryland farming. Deep plowing does little good in preventing erosion because the material brought up by the plow does not form stable clods.

Capability unit: VIe–2, dryland (IVe–7, irrigated). Range site: Sandy Flat.

Mansker series

In this series are brown to grayish-brown, calcareous soils that are 10 to 22 inches deep. They have developed in strongly calcareous, medium- to fine-textured, reddish sediments from outwash materials on plains. The vegetation on rangeland consists of a thin cover of short grasses, mainly gramas, and a few low catclaw and mesquite shrubs.

Mansker soils occur with Amarillo, Portales, and Potter soils. They are in small areas within larger areas of Portales soils, and in many places they surround areas of Potter soils. Mansker soils are shallower than the Portales soils and are deeper than the Potter soils. They are more calcareous, shallower, and less red than the Amarillo soils.

Because they occur in small areas, these soils are generally planted to cotton and grain sorghum along with the adjoining deeper soils. The grain sorghum often has chlorosis, or yellowing of leaves.

Mansker fine sandy loam, 3 to 5 percent slopes (MfC).—This soil has a slightly calcareous to strongly calcareous, dark-brown to grayish brown surface layer, 6 to 12 inches thick. The subsoil is lighter colored than the surface layer and is strongly calcareous. It is underlain by white to pink chalky earth at depths of 13 to 22 inches. Most of this soil is on slopes along ancient drains, normally in long, narrow bands.

Because of the slope and runoff from adjacent areas, many small gullies have formed. Loamy fine sand, 4 to 8 inches thick, has accumulated in many places where this soil occurs with sandy soils.

Representative profile:

Location: 0.35 mile east and 0.10 mile south of the northwest corner of section 93, block 4–X, E. L. and R. R. RR. Co. survey.

A_1 0 to 7 inches, dark-brown (10YR 4/3; 3/3, moist) fine sandy loam; weak, coarse, prismatic and weak, subangular blocky; slightly sticky when wet, very friable when moist, and soft when dry; many fine tubes and pores; common insect casts and burrows; many very fine roots; few medium to fine hard concretions of calcium carbonate; strongly calcareous; clear boundary.

AC 7 to 18 inches, light-brown (7.5YR 6/4; 5/4, moist) sandy clay loam; weak, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; many very fine tubes and pores; common insect casts and burrows; common, fine to very fine roots; common, fine to coarse, soft and hard concretions of calcium carbonate; few films and threads of calcium carbonate; very strongly calcareous; abrupt boundary.

C_{ca} 18 to 32 inches, pink (7.5YR 7/4; 6/4, moist) sandy clay loam; sticky when wet, friable when moist, and slightly hard when dry; many hard and soft, very fine to coarse concretions of calcium carbonate; a layer of semi-indurated white caliche about 1 inch thick in upper part of this horizon; very strongly calcareous; gradual boundary.

C 32 to 50 inches, reddish-yellow (7.5YR 8/6; 6/6, moist) clay loam; slightly sticky when wet, friable when moist, and slightly hard when dry; many very fine to coarse, hard and soft concretions of calicum carbonate; horizon contains more concretions and is more strongly calcareous than the C_{ca} horizon; very strongly calcareous.

Range in characteristics.—The A horizon ranges from 6 to 12 inches in thickness and from dark brown (7.5YR 4/4; 3/4, moist) to grayish brown (10YR 5/2; 4/2, moist) in color. The AC horizon is 5 to 13 inches thick and is reddish brown (5YR 5/4; 4/4, moist) to light brownish-gray (10YR 6/2; 5/2, moist).

The C_{ca} horizon is at depths of 13 to 22 inches. It is reddish brown (5YR 5/4; 4/4, moist) to white. The C horizon is at depths of 20 to 30 inches and is yellowish red (5YR 5/6; 4/6, moist) to white (10YR 8/2; 7/2, moist). In small areas, hard caliche occurs at depths of 18 to 22 inches, but normally these soils are underlain by soft caliche.

Inclusions.—The following, normally in areas less than 5 acres in size, may make up as much as 10 percent of each delineation of this soil:

Potter soils that are steep.

Areas that have accumulations of loamy fine sand, 4 to 8 inches thick.

Areas that have slopes as strong as 8 percent.

Use and management.—Because of the slopes, shallow depth, and hazard of both wind and water erosion, the use of this soil is limited. Its best use is perennial grass. The only feasible way to irrigate is by sprinklers.

Capability unit: VIe–1, dryland (IVe–6, irrigated).
Range site: Shallow Land.

Mansker fine sandy loam, 1 to 3 percent slopes (MfB).—This soil is slightly darker colored and less calcareous than Mansker fine sandy loam, 3 to 5 percent slopes. It has more areas underlain by hard caliche than that soil. It occurs on gently sloping benches above ancient drains or on slopes along playas.

A representative area of this soil is in section 4, block C–38, Public school land. Travel from the intersection of U.S. Highway 62 and State Highway 137 southeast on highway 137 for 11.04 miles, then 0.02 mile south and 0.13 mile west into cultivated field.

Use and management.—The use of this soil is limited because of its shallowness and, consequently, its low capacity to hold available moisture and plant nutrients. If it is cultivated, this soil is moderately susceptible to wind and water erosion.

Capability unit: IVe–4, dryland (IIIe–6, irrigated).
Range site: Shallow Land.

Mansker fine sandy loam, 0 to 1 percent slopes (MfA).—This soil is slightly darker colored and less calcareous than Mansker fine sandy loam, 1 to 3 percent slopes. It is a shallow soil that occurs within large areas of Portales fine sandy loam, 0 to 1 percent slopes.

A representative area is 0.4 mile north of the southeast corner of section 145, block D–11. This is about 4 miles northwest of Wellman.

Use and management.—Use of this soil is limited by its shallow depth. If cultivated, it is moderately susceptible to wind erosion.

Capability unit: IVe–4, dryland (IIIe–6, irrigated).
Range site: High Lime.

Mansker loam, 0 to 1 percent slopes (MlA).—This soil has a brown to dark grayish-brown surface layer, 4 to 6 inches thick. The subsoil is lighter colored and more strongly calcareous than the surface soil. At depths of 12 to 22 inches, the subsoil is underlain by very strongly calcareous material that has a whitish color. Most of this shallow soil occurs within large areas of Portales loam, 0 to 1 percent slopes.

Representative profile:

Location: 0.53 mile south and 0.45 mile east of the northwest corner of section 6, block Y, E. L. and R. R. RR. Co. survey. This is about 9 miles east and 0.50 mile south of Brownfield.

A_1 0 to 5 inches, dark grayish-brown (10YR 4/2; 3/2, moist) loam; weak, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; few very fine tubes and pores; few insects casts and burrows as much as 2 millimeters in diameter; many very fine roots; few hard, medium concretions and fragments of calcium carbonate throughout horizon; many hard, very coarse concretions and fragments of calcium carbonate on surface; strongly calcareous; gradual boundary.

AC 5 to 14 inches, grayish-brown (10YR 5/2; 4/2, moist) heavy clay loam; moderate, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; few very fine tubes and pores; many insect casts and burrows as much as 5 millimeters in diameter; many very fine roots; few very fine, hard concretions of calcium carbonate; very strongly calcareous; gradual boundary.

C_{ca} 14 to 30 inches +, very pale brown (10YR 8/3; 7/3, moist) heavy clay loam; very weak, prismatic and very weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; few very fine tubes and pores; few very fine roots; many insect casts and burrows as much as 2 millimeters in diameter; few very fine to very coarse, hard concretions and fragments of calcium carbonate; very strongly calcareous.

Range in characteristics.—The solum ranges from 12 to 22 inches in thickness.

The C_{ca} horizon may be indurated, or it may be made up of caliche of coarse gravel size.

Inclusions.—The following may make up as much as 5 percent of each delineation of this soil:

Portales loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.

Use and management.—This soil is of limited use because it is shallow and has a low capacity for holding available water and plant nutrients. It is susceptible to slight wind erosion if it is cultivated.

Capability unit: IVe–4, dryland (IIIe–6, irrigated).
Range site: High Lime.

Mansker loam, 1 to 3 percent slopes (MlB).—This soil is lighter colored and more strongly calcareous than Mansker loam, 0 to 1 percent slopes.

A representative area is 0.3 mile south and 0.4 mile east of the northwest corner of section 6, block Y, E. L. and R. R. RR. Co. survey.

Use and management.—In addition to its shallow depth and consequent low capacity to hold available water and plant nutrients, this soil is susceptible to moderate water erosion and to slight wind erosion.

Capability unit: IVe–4, dryland (IIIe–6, irrigated).
Range site: Shallow Land.

Mansker-Potter complex (Mp).—This complex consists of shallow and very shallow soils that occur on the slopes along draws. These soils are brown to grayish brown and are underlain by soft, white caliche. Slopes range from 3 to 8 percent but in most places are about 6 percent. Included in this mapping unit are small areas of Potter soils that have slopes as steep as 16 percent.

A representative area of this mapping unit extends for more than 3 miles along both sides of a draw that is about 1½ miles northwest of Brownfield. This area is 0.5 mile west and 0.1 mile north of the southeast corner of section 137, block T, D. and W. RR. Co. survey. It is several hundred acres in size.

The Potter soils occur on narrow ledges near the top of slopes and, as inclusions in other mapping units, in the steeper areas. They normally make up about 30 percent of the acreage of this complex.

The Mansker soils occur on less sloping areas above and below the knolls or ledges of Potter soils and make up about 70 percent of the mapping unit.

The soils of this mapping unit have shallow gullies and some alluvial fans at the base of slopes. The wind has caused accumulations of fine sand that cover about 15 percent of this mapping unit. On north-facing slopes near large areas of sandier soils, these accumulations are as much as 4 or 5 feet thick in many places. This is particularly true where areas of this mapping unit are in native vegetation and the adjoining areas of sandy soils are cultivated.

Use and management.—Because these soils have a thin solum, steep slopes, and high susceptibility to both wind and water erosion, they are not suited to cultivation. They are best suited to perennial grass.

Capability unit: VIe–3.
Range site: Shallow Land.

Portales series

This series consists of moderately deep, friable, calcareous soils that are permeable and moderately dark colored. They have developed in limy sediments on plains. A thick layer of soft caliche is at depths of 20 to 36 inches. These soils are smooth and have slopes that range from 0 to 3 percent but are normally less than 2 percent. They are in slight depressions. The vegetation consists of blue grama, buffalograss, and other short and mid grasses, as well as scattered small mesquite trees.

Portales soils occur with the Mansker, Zita, Amarillo, and Arch soils. They are deeper than the Mansker soils and are deeper and less limy than the Arch soils. They are shallower and less red than the Amarillo soils and are lighter colored and more calcareous than the Zita soils.

Portales soils have a large total acreage, mostly in cultivated crops. Although much of the acreage is dry-farmed, these soils are well suited to irrigation.

Portales fine sandy loam, 0 to 1 percent slopes (PfA).—This soil has a dark yellowish-brown to dark grayish-brown, calcareous surface layer, 6 to 14 inches thick. It is underlain by a lighter colored, more calcareous subsoil. The parent material is pale-brown to pink, very strongly calcareous clay loam and occurs at depths of 20 to 36 inches. Figure 8 shows a profile of this soil.

This soil is slightly more susceptible to wind erosion than the Amarillo fine sandy loams. Some areas have been winnowed by wind to the extent that there is 3 to 5 inches of loamy fine sand in the plow layer.

Representative profile:

Location: 0.22 mile south and 0.04 mile west of the northeast corner of section 9, block C–38, Public school land. This is about 13 miles southeast of Brownfield.

A_p 0 to 13 inches, brown (10YR 5/3; 4/3, moist) fine sandy loam; structureless; slightly sticky when wet, very friable when moist, and soft when dry; about 50 percent of the horizon, by volume, consists of clods of sandy clay loam from the AC_1 horizons; slight surface crusting; few hard concretions and fragments of calcium carbonate as much as 5 millimeters in diameter on surface; few very fine roots; weakly to strongly calcareous; abrupt boundary.

AC_1 13 to 24 inches, pale-brown (10YR 6/3; 5/3, moist) sandy clay loam; weak, coarse, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; many very fine tubes and pores; many insect casts and burrows as much as 5 millimeters in diameter; strongly calcareous; gradual boundary.

AC_2 24 to 33 inches, very pale brown (10YR 7/3; 6/3, moist) sandy clay loam; weak, subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; few fine tubes and pores; few very fine roots; few soft concretions of calcium carbonate; strongly calcareous; gradual boundary.

C_{ca} 33 to 62 inches, pink (7.5YR 8/4; 7/4, moist) sandy clay loam; sticky when wet, friable when moist, and slightly hard when dry; many concretions of calcium carbonate as much as 5 millimeters in diameter; about 50 percent of horizon, by volume, consists of

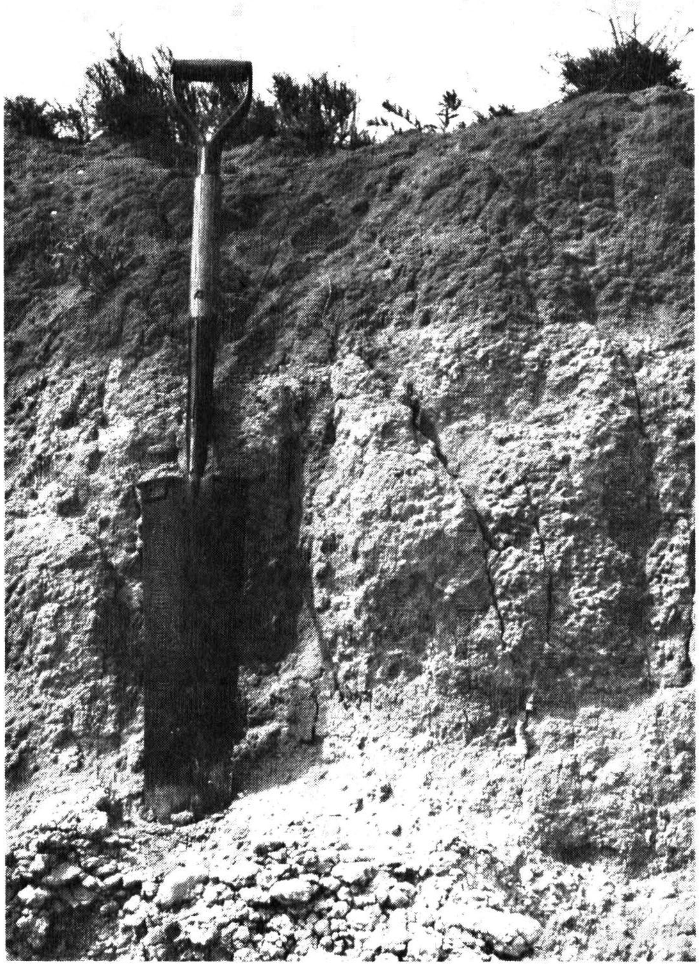

Figure 8.—**Portales fine sandy loam, 0 to 1 percent slopes. The dark upper layer is the A horizon. The lighter colored second layer is the AC horizon. The mass of calcium carbonate concretions at the point of the spade is the C_{ca} horizon.**

free calcium carbonate; very strongly calcareous; gradual boundary.

C 62 to 84 inches +, reddish-yellow (5YR 6/6; 5/6, moist) sandy clay loam; few soft, small concretions of calcium carbonate; strongly calcareous.

Range in characteristics.—The A horizon ranges from dark grayish brown (10YR 4/2; 3/2, moist) to dark yellowish brown (10YR 4/4; 3/4, moist)in color and from 6 to 14 inches in thickness. The AC horizon is grayish brown (10YR 5/2; 4/2, moist) to brown (7.5YR 5/4; 4/4, moist) and is 8 to 19 inches thick.

The C_{ca} horizon is at depths of 21 to 36 inches. It is very pale brown (10YR 7/3; 6/3, moist) to pink (7.5YR 8/4; 7/4, moist) and is 15 to 30 inches thick. The C horizon or other horizon underlying the C_{ca} horizon ranges from very pale brown (10YR 7/3; 6/3, moist) to pink (5YR 8/3; 7/3, moist) in color.

Inclusions.—The following areas, normally less than 5 acres in size, may make up as much as 5 percent of each delineation of this soil:

Zita fine sandy loam, 0 to 1 percent slopes, in depressed areas.
Arch loam.
Mansker fine sandy loam, 0 to 1 percent slopes, on slight mounds.
Portales loam, 0 to 1 percent slopes.

Use and management.—Yields of cotton, grain sorghum, and grasses are good if you irrigate or dry-farm this soil. If it is irrigated, this soil generally needs additions of nitrogen and phosphate. It may be irrigated by the sprinkler, level-furrow, or level-border methods.

Capability unit: IIIe-2, dryland (IIe-2, irrigated).
Range site: High Lime.

Portales fine sandy loam, 1 to 3 percent slopes (PfB).—This soil is thinner in the surface layer than Portales fine sandy loam, 0 to 1 percent slopes, and normally is lighter colored and more calcareous. It is slightly browner than the more nearly level soil and in many places has a reddish hue throughout the profile. Most areas have slopes of less than 2 percent. In many places small gullies have formed.

A representative area is 0.54 mile south and 100 feet west of the northeast corner of section 4, block C-38, Public school land. This is about 13 miles southeast of Brownfield.

Use and management.—If it is cultivated, this soil is susceptible to moderate sheet, gully, and wind erosion. The most efficient way to irrigate is by sprinklers.

Capability unit: IIIe-3 (dryland and irrigated).
Range site: High Lime.

Portales loam, 0 to 1 percent slopes (PlA).—This soil has a grayish-brown to dark grayish-brown, calcareous clay loam surface layer, 12 to 18 inches thick. The subsoil is lighter colored and more calcareous than the surface layer. It is 7 to 18 inches thick. White to pink, very strongly calcareous parent material is at depths of 22 to 36 inches.

This soil has a small total acreage. It occurs on benches between the sloping Drake soils and the Randall clay soils on the playa beds.

Representative profile:

Location: 0.6 mile south and 0.1 mile east of the northeast corner of section 27, block C-39, Public school land.

A_{11} 0 to 12 inches, brown (10YR 4/3; 3/3, moist) loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; common fine tubes and pores; many fine roots; many insect casts and burrows as much as 5 millimeters in diameter; strongly calcareous; gradual boundary.

A_{12} 12 to 17 inches, brown (10YR 5/3; 4/3, moist) clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few fine tubes and pores; common insect casts and burrows as much as 5 millimeters in diameter; strongly calcareous; clear boundary.

AC 17 to 24 inches, very pale brown (10YR 7/3; 6/3, moist) clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few fine roots; few tubes and pores; few insect casts and burrows as much as 5 millimeters in diameter; very strongly calcareous; abrupt boundary.

C_{ca} 24 to 35 inches white (10YR 8/2; 7/2, moist) light clay loam; about 10 percent of horizon, by volume, consists of concretions of calcium carbonate; very strongly calcareous; clear boundary.

C 35 to 57 inches +, pink (7.5YR 8/4; 7/4, moist) sandy clay loam; strongly calcareous.

Range in characteristics.—The A horizon is grayish brown to dark grayish brown in hue of 10YR, value of 4 to 5, and chroma of 2 to 3. It is 12 to 18 inches thick. The AC horizon is lighter in color; it is one to two units higher in value. It ranges from 7 to 18 inches in thickness.

The C_{ca} horizon is at depths of 22 to 36 inches. It is pink to white in hue of 7.5 to 10YR, value of 7 to 8, and chroma of 2 to 4.

Inclusions.—Arch and Mansker soils having a loam surface soil may make up as much as 2 percent of each delineation of this soil. These inclusions normally occur on slight slopes or on ridges.

Use and management.—This soil will produce excellent yields of cotton and grain sorghum if it is irrigated or if rainfall is higher than average. In drier years, however, yields are lower than on the Portales fine sandy loams. Save as much of the water that falls on this soil as you can. This soil is susceptible to slight to moderate wind erosion.

Capability unit: IIIce-1, dryland (IIe-1, irrigated).
Range site: High Lime.

Potter series

In this series are very shallow, grayish-brown to brown, calcareous soils that are underlain by thick layers of soft or semihard caliche. These soils occur on the steep slopes of ancient drains. They have short, convex slopes that range from 5 percent along the shallower drains to as much as 20 percent along the deeper drains. The vegetation on rangeland consists of blue grama, black grama, and a moderate stand of broom snakeweed.

These soils occur with the Mansker soils. They are steeper, shallower, and lighter colored than the Mansker soils. They are not suited to cultivated crops.

Potter soils (Ps).—These grayish-colored to brown soils range from fine sandy loam to clay loam in texture and from 2 to 10 inches in thickness. They are underlain by soft to hard caliche.

These soils are often gullied in many places by runoff from adjacent higher lying areas. Where they occur with sandy soils, they have an accumulation of loamy fine sand that is 4 to 6 inches deep in many places.

Representative profile:

Location: 0.58 mile south and 0.13 mile west of the northeast corner of section 60, block D-14, C. and M. RR. Co. survey. This is about 14 miles west and 5½ miles south of Brownfield.

A 0 to 4 inches, brown (10YR 4/3; 3/3, moist) heavy fine sandy loam; weak, subangular blocky and granular structure; slightly sticky when wet, very friable when moist, and slightly hard when dry; many very fine roots; many hard fragments and concretions of calcium carbonate as much as 7 inches in diameter on the surface; strongly calcareous; abrupt boundary.

C 4 to 20 inches +, white chalky earth that is semi-indurated in upper part.

Range in characteristics.—The surface soil is fine sandy loam, loam, or gravelly loam. The underlying material is soft chalky earth that contains little gravel or is semi-indurated caliche containing large fragments of secondary limestone.

Inclusions.—The following may make up as much as 15 percent of each delineation of this soil:

Mansker fine sandy loams that occur in small swales in the slopes of Potter soils.

Mansker soils on the more gentle slopes above and below the steeply sloping Potter soils.

Use and management.—Because of extreme shallowness and steep slopes, these soils are not suited to cultivation. Their best use is rangeland.

Capability unit: VIIs-1.
Range site: Shallow Land.

Randall series

This series consists of poorly drained, grayish-colored, clayey soils on the floor of small playas. These soils have very slow internal drainage and no external, or surface, drainage. They are covered with water for many days and often for weeks after long rainy periods.

Randall soils occur in many small areas and are normally cultivated along with the surrounding soils.

Randall clay (Rc).—This soil has a gray to light brownish-gray, clayey surface layer, 8 to 26 inches thick. The surface layer is underlain by a tough, plastic, lighter colored clay that has had little profile development. Slopes are less than 1 percent.

This soil is farmed in many areas. Yields are good in years of low rainfall. A gilgai, or buffalo-wallow, microrelief is common where these soils are in pasture or range.

Representative profile:

Location: 0.04 mile south and 0.22 mile west of the northeast corner of section 87, block 4-X, E. L. and R. R. RR. Co. survey. This is about 9 miles northeast of Brownfield.

A_{1p} 0 to 16 inches, dark-gray (10YR 4/1; 3/1, moist) clay; structureless; very sticky when wet, firm when moist, and very hard when dry; few fine roots; noncalcareous; abrupt boundary.

A_{12} 16 to 26 inches, dark-gray (10YR 4/1; 3/1, moist) clay; moderate, medium blocky and strong, fine angular blocky; very sticky when wet, firm when moist, and very hard when dry; few very fine roots; noncalcareous; clear boundary.

AC_1 26 to 34 inches, gray (10YR 5/1; 4/1, moist) clay or heavy clay loam; moderate, fine blocky; very sticky when wet, firm when moist, and very hard when dry; few very fine roots; common, medium, faint mottles of pale brown (10YR 6/3; 5/3, moist); noncalcareous; clear boundary.

C 34 to 57 inches +, grayish-brown (10YR 5/2; 4/2, moist) heavy clay loam; very sticky when wet, very firm when moist, and very hard when dry; common, medium, faint mottles of gray (10YR 5/1; 4/1, moist) and few medium, distinct mottles of yellow (10YR 7/6; 6/6, moist); lower 6 inches of horizon contains few soft concretions of calcium carbonate, is heavy sandy clay loam in texture, and is slightly calcareous; upper part of horizon noncalcareous.

Range in characteristics.—The horizons range in color from dark gray to light brownish gray, in hue of 10YR, value of 4 to 6, and chroma of 1 to 2.

Inclusions.—In many places 2 to 6 inches of fine sandy loam has accumulated on this soil in areas that occur with cultivated areas of other soils.

Use and management.—Because of flooding and, consequently, drowning of crops, this soil is extremely limited in use.

Capability unit: VIw-1.
Range site: Deep Hardland.

Randall fine sandy loam (Rf.)—This soil is in shallow playas, where it occurs with more sloping, sandy soils. It has a fine sandy loam surface layer 8 to 24 inches thick. This material was deposited by wind and water. It is underlain by gray to dark-gray clay that is similar to Randall clay.

A representative area is 0.4 mile east and 100 feet north of the southwest corner of section 30, block X, E. L. and R. R. RR. Co. survey.

Use and management.—Except during years of extremely high rainfall, this soil can be successfully cultivated. It is seldom completely covered by water. After heavy rains, the surface normally dries within a week.

Capability unit: IVw-1.
Range site: Deep Hardland.

Spur series

In this series are brown to dark grayish-brown, friable soils that are on narrow flood plains of both sides of ancient drains. These soils consist of alluvium that has accumulated in narrow valleys at the base of the sloping Potter and Mansker soils. Runoff is slow to moderate, and internal drainage is moderate. These soils are flooded occasionally, but the water recedes quickly and causes little damage.

Spur soils have a small total acreage. They are very fertile, and most areas are in cotton and grain sorghum.

Spur fine sandy loam (Sf).—This soil has a brown to dark-brown surface layer, 8 to 18 inches thick. The subsoil is brown to dark grayish brown in the upper part and is lighter colored with increasing depth. As a result of wind winnowing and accumulations from nearby sandy areas, some areas have 3 to 6 inches of loamy fine sand in the plow layer. Slopes are less than 1 percent.

Representative profile:

Location: 0.3 mile west and 0.2 mile south of the northeast corner of section 75, block D–11, C. and M. RR. Co. survey.

A_p 0 to 18 inches, dark-brown (7.5YR 4/4; 3/4, moist) fine sandy loam; structureless; slightly sticky when wet, friable when moist, and slightly hard when dry; common fine roots; few tubes and pores; few hard fragments of calcium carbonate; weakly calcareous; abrupt boundary.

AC_1 18 to 32 inches, dark grayish-brown (10YR 4/2; 3/2, moist) sandy clay loam; weak, subangular blocky; sticky when wet, friable when moist; and hard when dry; common fine roots; few tubes and pores; few hard fragments of calcium carbonate; weakly calcareous; gradual boundary.

AC_2 32 to 40 inches, brown (10YR 5/3; 4/3, moist) sandy clay loam; weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; strongly calcareous; clear boundary.

D 40 to 62 inches +, light-gray (10YR 7/1; 6/1, moist) clay loam; appears to be pure caliche; very strongly calcareous.

Range in characteristics.—The A horizon is 8 to 18 inches thick. Colors throughout the profile are in hues of 10YR and 7.5YR with values of 3 to 5 and chromas of 2 to 4. This soil may be noncalcareous to a depth of 30 inches or calcareous throughout the profile.

The depth to the underlying, white, chalky material ranges from 40 to 60 inches or more. Some areas on the sides of the draws have slopes of about 2 percent.

Use and management.—Spur fine sandy loam is very fertile and receives water from adjoining areas. It has good yields of cotton, grain sorghum, and grasses. The hazard of wind erosion is moderate.

Capability unit: IIIe–2, dryland (IIe–2, irrigated).

Range site: Bottom Land.

Spur loamy fine sand (Sl).—This soil has a surface layer that consists of an accumulation of loamy fine sand, 8 to 15 inches thick. In other respects it is similar to Spur fine sandy loam. The loamy fine sand has accumulated on the bottom of draws. It came from nearby sandy fields that have been cultivated for a long time without much control of erosion.

A representative area is 0.6 mile north of the southwest corner of section 39, block O, H. and O. B. RR. Co. survey. This is about 11 miles southeast of Brownfield.

Use and management.—Because the surface is sandy, this soil is highly susceptible to wind erosion. Use plant cover, roughness, and cloddiness to control wind erosion.

Capability unit: IVe–3, dryland (IIIe–5, irrigated).

Range site: Bottom Land.

Spur clay loam (Sc).—This soil has brown to dark grayish-brown surface layers (A horizon) that are underlain by a lighter colored, weakly calcareous subsoil. The subsoil extends to depths of many feet.

This soil occurs in the northwestern part of the county in an area on the nearly level bottom of an intermittent stream about 300 feet wide. It has a small total acreage, which is mostly rangeland. The vegetation consists primarily of buffalograss and vine mesquite.

Representative profile:

Location: 0.55 mile west and 0.68 mile south of the northeast corner of section 18, block D–11, C. and M. RR. Co. survey. This is about 16 miles northwest of Brownfield.

A_{11} 0 to 3 inches, brown (10YR 4/3; 3/3, moist) light clay loam; structureless; very sticky when wet, firm when moist, and hard when dry; many very fine roots; noncalcareous; clear boundary.

A_{12} 3 to 22 inches, dark-brown (10YR 3/3; 2/3, moist) clay loam; weak, prismatic and weak, subangular blocky; sticky when wet, firm when moist, and hard when dry; many very fine tubes and pores as much as 1 millimeter in diameter; many insect casts and burrows as much as 3 millimeters in diameter; many very fine roots, especially in upper 10 inches; noncalcareous except in lower part; gradual boundary.

AC 22 to 34 inches, very dark grayish-brown (10YR 3/2; 2/2, moist) clay loam; weak, subangular blocky; very sticky when wet; firm when moist, and very hard when dry; few very fine tubes and pores; few very fine insect casts and burrows; weakly calcareous; clear boundary.

AC_2 34 to 58 inches, dark-brown (10YR 4/3; 3/3, moist) clay loam; sticky when wet, firm when moist, and hard when dry; weakly calcareous; abrupt boundary.

C 58 to 66 inches +, brown (10YR 5/3; 4/3, moist) clay loam; sticky when wet, firm when moist, and hard when dry; weakly calcareous.

Range in characteristics.—The A horizon is brown to dark grayish brown. This horizon may be a recent accumulation. In many places, this soil is calcareous to the surface.

Use and management.—Although this soil receives water from higher areas, it is somewhat droughty during years of low rainfall. It has only a slight hazard of wind erosion and water erosion. If all the water that falls on this soil is retained, yields are excellent.

Capability unit: IIIce–1, dryland (IIe–1, irrigated).

Range site: Bottom Land.

Tivoli series

In this series are deep, light-colored, loose sands that were deposited by wind. These soils are very undulating to rolling and consist partly of stabilized dunes 2 to 12 feet high and as much as 100 feet in diameter. They are in the higher elevations in the northwestern part of the county. The vegetation consists of a thick stand of shin oak and a sparse stand of sand bluestem, little bluestem, and other tall grasses.

These soils occur with Brownfield soils, which are on smoother, lower lying areas adjacent to or intermingled with Tivoli soils.

Only one Tivoli soil is mapped in Terry County. Because the hazard of erosion is very high, this soil is not suited to cultivation. It is used for rangeland.

Tivoli fine sand (Tv).—This soil has a surface layer of pale-brown to light yellowish-brown fine sand slightly darkened by organic matter. The surface layer is 5 to 10 inches thick. It is underlain by a very pale brown to reddish-yellow, loose, fine sand that extends to a depth of many feet.

Representative profile:

Location: 0.95 mile south and 0.15 mile west of the northeast corner of section 8, block D–14, C. and M. RR. Co. survey.

A 0 to 5 inches, pale-brown (10YR 6/3; 5/3, moist) fine sand; structureless; nonsticky when wet, loose when moist, and very loose when dry; few very fine roots and few larger ones as much as 2 inches in diameter; noncalcareous; gradual boundary.

C 5 to 72 inches, very pale brown (10YR 7/3; 6/3, moist) fine sand; structureless; nonsticky when wet, loose when moist, and very loose when dry; few very fine roots as much as 2 millimeters in diameter in upper part; noncalcareous; diffuse boundary.

Range in characteristics.—The A horizon ranges from 5 to 10 inches in thickness. It is brown (10YR 5/3; 4/3, moist) to pale brown or light yellowish brown (10YR 6/4; 5/4, moist) in color, but is predominately pale brown.

The C horizon is light yellowish brown to very pale brown.

Inclusions.—Small areas of Brownfield fine sand, thick surface, make up a part of some delineations of this soil. In many places this inclusion is intermingled with Tivoli fine sand in such an intricate pattern that separation of the two soils is impractical.

Use and management.—This Tivoli soil is not suited to cultivation. It has a very high hazard of wind erosion and has a low capacity to hold water and plant nutrients. It is best used as rangeland.

Capability unit: VIIe-2.
Range site: Sand Hill.

Zita series

The Zita series consists of brown to very dark grayish-brown soils that are noncalcareous to depths of 12 to 30 inches. These soils are 18 to 40 inches deep over a distinctly chalky layer of calcium carbonate. They are nearly level and occur in slight depressions.

Zita soils occur with the Portales and Amarillo soils. They are darker colored and less calcareous than the Portales soils. Zita soils are less red and shallower than the Amarillo soils and are at slightly lower elevations.

Only one Zita soil is mapped in the county. This soil, which has a small total acreage, is used for cultivated crops.

Zita fine sandy loam, 0 to 1 percent slopes (ZfA).—This soil has brown to dark grayish-brown surface layers (A horizon), 5 to 17 inches thick. The subsoil is lighter in color than the surface layers and slightly more clayey. Pale-brown to pink, very strongly calcareous parent material occurs at depths of 18 to 70 inches.

This soil normally receives some runoff from the surrounding, slightly higher soils. Many areas have 2 to 6 inches of loamy fine sand in the plow layer. This is a result of wind winnowing and some accumulation from surrounding sandier soils.

Representative profile:

Location: 0.70 mile south and 0.28 mile west of the northeast corner of section 4, block C-38, Public school land. This is about 12 miles southeast of Brownfield.

A_{1p} 0 to 12 inches, brown (10YR 4/3; 3/3, moist) fine sandy loam; structureless; slightly sticky when wet, very friable when moist, and soft when dry; surface shows some crusting; noncalcareous; abrupt boundary.

A_{12} 12 to 17 inches, dark grayish-brown (10YR 4/2; 3/2, moist) sandy clay loam; moderate, coarse prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few very fine roots; many fine tubes and pores; many insect casts and burrows as much as 4 millimeters in diameter; noncalcareous; gradual boundary.

AC 17 to 27 inches, brown (10YR 4/3; 3/3, moist) sandy clay loam; moderate, coarse prismatic and weak, subangular blocky; sticky when wet, friable when moist, and hard when dry; few very fine tubes and pores; few very fine roots; few insect casts and burrows as much as 3 millimeters in diameter; few threads and films of calcium carbonate; weakly calcareous; diffuse boundary.

C_{ca1} 27 to 36 inches, light brownish-gray (10YR 6/2; 5/2, moist) sandy clay loam; weak subangular blocky; sticky when wet, friable when moist, and slightly hard when dry; few very fine roots; many threads and films of calcium carbonate; very strongly calcareous; clear boundary.

C_{ca2} 36 to 60 inches, very pale brown (10YR 7/4; 6/4, moist) sandy clay loam; sticky when wet, friable when moist, and slightly hard when dry; few soft concretions of calcium carbonate in upper 8 inches; many soft concretions of calcium carbonate in lower part; very strongly calcareous; gradual boundary.

C 60 to 82 inches +, pink (7.5YR 7/4; 6/4, moist) sandy clay loam with many coarse mottles of pinkish white; strongly calcareous.

Range in characteristics.—The A_p horizon ranges from 5 to 17 inches in thickness. It is dark grayish brown (10YR 4/2; 3/2, moist) to grayish brown (10YR 5/2; 4/3, moist). The surface soil is calcareous in some places. The AC horizon is very dark grayish brown (10YR 3/2; 2/2, moist) to brown (10YR 5/3; 4/3, moist). The depth to the very pale brown C_{ca} horizon ranges from about 20 to 50 inches but is normally about 25 to 30 inches.

Semi-indurated caliche occurs at depths of about 36 inches in some areas where this soil occurs with the Arvana or Mansker soils.

Inclusions.—The following may make up as much as 15 percent of each delineation of this soil:

- Areas of a Portales fine sandy loam, 6 to 20 feet in diameter.
- Some small areas of coarse-textured soils that have been plowed to sufficient depth to bring part of the C_{ca} horizon to the surface. The surface layer in these areas, because of the high content of lime, is very strongly calcareous and very pale brown to white.
- Low-lying soils with a surface soil that is nearly loam.

Use and management.—Zita fine sandy loam, 0 to 1 percent slopes, produces good yields of cotton and other crops. This soil benefits from the water it receives from the adjoining soils. It is susceptible to moderate wind erosion.

Capability unit: IIIe-2, dryland (IIe-2, irrigated).
Range site: Mixed Land.

Effects of Wind Erosion

Any description of Terry County soils would be incomplete without a discussion of the effects of wind erosion. Although the term, "eroded," does not appear in the soil names, all of the cultivated soils and some of the soils in range areas have been altered by the wind. On cultivated soils this alteration may include the removal of as much as one-half of the original A horizon; the removal of much of the organic matter, silt, and clay from the plow layer; or the accumulation of 4 to 6 inches of sandy material.

The finer textured soils—clay loams and loams—have been affected the least by wind erosion. This is because these soils generally can be roughened and clodded by tillage so that they resist the action of wind. Nevertheless, much of the organic matter, and of the silts and clays, has been winnowed out by the wind. These materials have been removed to the extent that the surface soils are now coarser textured and somewhat lighter colored than they were before the soils were first cultivated. Consequently, these finer textured soils—clay loams and loams—have become more susceptible to erosion and have reduced capacities for holding water and plant nutrients.

The fine sandy loams, which are moderately susceptible to wind erosion, have been greatly altered by wind action.

Some small areas have had nearly all of the original surface layers (A horizon) removed by wind. In these areas, low yields of crops reflect reduced fertility and poorer plant-soil-moisture-air relationship. Probably the most damaging effect of the wind on these soils has been the removal of the organic matter, silts, and clays from the plow layer. The sandy surface layer that remains is very infertile and is highly susceptible to wind erosion. In an effort to offset these effects, farmers have plowed deeper and deeper to bring up more of the clayey material from below. In spite of deep plowing, wind winnowing has continued in some areas to the extent that the upper 10 to 12 inches of the soils has been changed from fine sandy loam to coarser loamy fine sand.

The coarse-textured loamy fine sands and fine sands show the most extreme effects of wind erosion. In cultivated areas, fence-row dunes as much as 10 feet high are common. Farm buildings are often nearly surrounded by loose sand dunes. County roads may be closed by drifting sand in one strong blow. Because of the shifting sand that is blown about early in spring, farmers often have to plant three or four times. Abandoned fields may lose all of their thick sandy surface soil (see fig. 8). The infertile sand blown from these areas to adjoining areas of more productive soils is especially damaging.

Rangeland is also damaged by the wind. Some of the soil on the range is shifted and removed, but most of the damage is caused by sand blown in from cultivated land. Sand blown from adjoining sandy areas may cover several acres of rangeland with a layer of sand 6 inches to 3 feet thick. This layer smothers the desirable grasses and allows annual weeds and brush to start invading. The clays and silts that are removed from cultivated land cause one of the least noticed yet most damaging effects. These small particles are picked up by wind from the shifting cropland and are carried many miles. Some of the particles are deposited in a thin mantle on much of the rangeland. Although this mantle is only 1/8 to 1/2 inch thick, it forms a very effective crust that reduces the intake of water. Runoff and water erosion are increased and desirable grasses lose moisture that is greatly needed.

Use and Management of Soils [2]

This section consists of three main parts. The first part describes land capability classification and discusses use and management for each capability unit, or management group. The second part consists of a table that gives, for each soil cultivated, estimated yields of dryland and irrigated cotton and grain sorghum under two levels of management. In the third part, general practices of soil management are discussed. The use and management of rangeland are discussed in a separate section, which follows this section.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable the 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.

[2] This section was written by WILLIAM M. MILLER, management agronomist, Soil Conservation Service.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through 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 land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, 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, IIIe. The letter *e* shows that the main limitation is risk of erosion unless 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* indicates that the chief limitation is climate that is too cold or too dry. In Terry County *c* is used together with *e* in subclass IIIce to indicate that the soils are droughty as well as susceptible to erosion.

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 subclassses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, which are groups of soils 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 that allows us to make many statements about the management of soils. Capability units are generally identified by numbers assigned locally, for example, IIIce-1 or IVe-1.

Soils are classified in capability classes, subclasses, and units in accordance with the degrees and kinds of permanent limitations of the soils. Not considered in this classification are major and generally expensive land forming that would change the slope, depth, or other characteristic of the soil, and not considered are possible but unlikely major reclamation projects.

In the following outline are the capability classes, subclasses, and units in Terry County and a brief description of the soils that make up these classification groups. Terry County has no dryland soils in classes I, V, or VIII.

Class III.—Soils having severe limitations that reduce the choice of plants, require special conservation, or both.
- Subclass IIIce: Soils that are droughty and susceptible to slight wind or water erosion.
  - Unit IIIce-1 (IIe-1, irrigated): Nearly level, reddish-brown to dark grayish-brown clay loams and sandy clay loams with a high capacity for holding water and plant nutrients.
- Subclass IIIe: Soils susceptible to moderate water erosion and moderate or slight wind erosion.
  - Unit IIIe-1: Gently sloping, reddish-brown to

brown loam that has a high capacity for holding water and plant nutrients.

Unit IIIe–2 (IIe–2, irrigated): Nearly level, deep, reddish-brown to dark yellowish-brown fine sandy loams that have a moderate capacity for holding water and plant nutrients.

Unit IIIe–3: Gently sloping, deep, reddish-brown to dark yellowish-brown fine sandy loams that have a moderate capacity for holding water and plant nutrients.

Class IV.—Soils having very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe: Soils susceptible to moderate to severe wind erosion and slight to severe water erosion.

Unit IVe–1: Deep, moderately permeable, brown to reddish-brown fine sandy loam that is strongly sloping.

Unit IVe–2 (IIIe–4, irrigated): Light-gray to brown, moderately deep to deep, loamy soils that are high in lime.

Unit IVe–3 (IIIe–5, irrigated): Deep, reddish-brown to dark-brown loamy fine sands that have a low capacity for holding plant nutrients and water.

Unit IVe–4 (IIIe–6, irrigated): Shallow, reddish-brown to brown loams to fine sandy loams.

Unit IVe–5 (IIIe–7, irrigated): Deep, reddish-brown to red sandy soils that have a low capacity to hold water and plant nutrients.

Subclass IVw: Soils that are limited by excess water.

Unit IVw–1: Brown to dark-brown fine sandy loam in shallow playas.

Class VI.—Soils having severe limitations that make them unsuited to cultivation and limit their use largely to pasture, range, or wildlife cover.

Subclass VIe: Soils susceptible to severe water erosion or wind erosion.

Unit VIe–1 (IVe–6, irrigated): Light-gray to brown soils that have short slopes.

Unit VIe–2 (IVe–7, irrigated): Pale-brown to yellowish-red fine sands to loamy fine sands that have a low capacity for holding plant nutrients and water.

Unit VIe–3: Shallow to very shallow, brown to yellowish-red soils that are nearly level to strongly sloping.

Subclass VIw: Soils that are limited in their use by excess water.

Unit VIw–1: Weakly developed, gray to light brownish-gray, poorly drained soils in shallow playas.

Class VII.—Soils having very severe limitations that make them unsuited to cultivation and that restrict their use to pasture, range, or wildlife cover.

Subclass VIIe: Soils susceptible to very severe wind or water erosion.

Unit VIIe–1: Brown to grayish-brown clay loams to fine sandy loams that are steep to strongly sloping.

Unit VIIe–2: Deep, pale brown to light yellowish-brown, extremely sandy soil.

Unit VIIe–3: Deep, brown to yellowish-red, severely eroded sandy soils.

Subclass VIIs: Soils severely limited in use because of shallowness.

Unit VIIs–1: Brown to grayish-brown clay loams to fine sandy loams that are very shallow.

Management by capability units

In this subsection the soils are listed in their appropriate capability units, or management groups, and characteristics that affect their management are given. The uses of the soils are stated, and management is suggested for dryland farming and for irrigated farming. Some soils belong in a different capability unit when they are irrigated instead of dry-farmed. The soils of capability unit IIIce–1, for example, belong in unit IIe–1 if they are irrigated. If the capability unit for a group of soils is different under irrigation, because the limitation of low rainfall is thus removed, this is indicated in parentheses, following the name of the unit; to illustrate, "Capability unit IIIce–1, (IIe–1, irrigated)."

CAPABILITY UNIT IIIce–1 (IIe–1, IRRIGATED)

This group consists of deep, reddish-brown to dark grayish-brown loams and a clay loam. These soils are level to nearly level. They are:

Amarillo loam, 0 to 1 percent slopes.
Portales loam, 0 to 1 percent slopes.
Spur clay loam.

These soils have a slight to moderate susceptibility to wind erosion and a slight susceptibility to water erosion. They have a high capacity for holding water and plant nutrients and are moderately permeable.

The main cash crop grown on these soils is cotton. Other cash crops are grain sorghum and small grains. Alfalfa, vetch, Austrian winter peas, and cowpeas are suitable crops. These crops fix some nitrogen from the atmosphere when properly inoculated and irrigated. Native grasses are also suited to these soils.

Dryland.—The cropping system should include, every year, at least half the acreage in grain sorghum, a small grain, or another crop that leaves large amounts of residue on the soil. If the soil is stubble mulched, or residue is used to cover the surface, this residue helps to keep organic matter at a high level. In addition, it provides cover during hazardous periods and reduces erosion. During or following periods of low rainfall, when there is not enough residue to prevent soil blowing, these soils may be chiseled or listed so that they will be cloddy and rough. Farming on the contour and the terracing of long slopes reduces water erosion and conserves moisture.

Irrigated.—These soils are very productive if they are irrigated. The cropping system should provide a soil-improving crop on one-third of the acreage each year. Preferably, this crop should leave large amounts of residue on the soil. Add commercial fertilizers to increase yields. Deep-rooted legumes or grasses improve the tilth. Return crop residue to the soil. Suitable methods of irrigation are the level border, level or graded furrow, and sprinkler.

CAPABILITY UNIT IIIe–1

The only soil in this capability unit is Amarillo loam, 1 to 2 percent slopes. This soil is deep, reddish-brown to brown loam that is gently sloping. It is moderately permeable and has a high capacity to hold available mositure and plant nutrients. Runoff is rapid during heavy rains.

Conserve as much water as possible so that enough moisture is available for crops to produce high yields. Terraces and contour tillage conserve moisture and help to control water erosion as well. This soil is susceptible to slight wind erosion and to moderate water erosion.

Cotton is the main cash crop, but grain sorghum and small grains are also grown as cash crops. Native grasses do well. If the soil is irrigated, alfalfa is suited. Other suitable crops under irrigation are Austrian winter peas, cowpeas, and vetch.

Dryland.—Use a cropping system that provides crops that leave large amounts of residue on the soil on about three-fifths of the acreage each year. In some cropping systems this kind of crop is grown continuously. If properly used during critical seasons, crop residue helps to control erosion and provides organic matter that improves the soil. During or following dry years, when little crop residue is produced, this soil should be chiseled, listed, or otherwise tilled so that the soil surface is left cloddy and rough. To conserve moisture and reduce water erosion, farm on the contour and terrace long slopes.

Irrigated.—This soil is very productive under irrigation. Use a cropping system that, on one-half the land each year, includes a soil-improving crop, preferably one that produces large amounts of residue. Commercial fertilizers can be added to maintain high yields. Deep-rooted legumes or grasses improve the soil. Tillage may increase the initial intake and temporary storage of water. Suitable ways to irrigate are by the sprinkler, level-furrow, and level-border methods. When sprinkler irrigation is used, terraces and contour farming help conserve moisture and reduce water erosion.

CAPABILITY UNIT IIIe-2 (IIe-2, IRRIGATED)

The soils in this group are deep, reddish-brown to dark yellowish-brown fine sandy loams that are nearly level. These soils are less susceptible to wind erosion when they are irrigated than when they are dry farmed. For this reason, irrigated soils in this group are placed in capability unit IIe-2. The soils in the group are:

Amarillo fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Portales fine sandy loam, 0 to 1 percent slopes.
Spur fine sandy loam.
Zita fine sandy loam, 0 to 1 percent slopes.

These soils are susceptible to moderate wind erosion and to slight water erosion. They have a moderate capacity to hold water and plant nutrients and are moderately permeable. The Portales soil absorbs water at a slightly higher rate than the other soils.

Cotton is the main cash crop, but grain sorghum and small grains are also grown as cash crops. Native grasses do well. If these soils are irrigated, alfalfa is suited. Other suitable crops under irrigation are vetch, Austrian winter peas, guar, and cowpeas.

Dryland.—A crop that leaves large amounts of residue should be on about two-thirds of the cultivated acreage in these soils, or this kind of crop should be grown continuously. The residue on the soil helps control erosion and helps keep the soil in good condition. In years when the amount of residue is inadequate, roughen the surface by tillage to help control erosion. Occasionally plant a crop that increases fertility and productivity. To conserve moisture and to reduce water erosion, farm on the contour and terrace long slopes.

Irrigated.—These soils are very productive if they are irrigated. About one-third of the time, the cropping system should include a crop that improves the soil, preferably one that leaves large amounts of residue. Commercial fertilizer may be added to increase yields. Deep-rooted legumes or grasses improve tilth. Tillage may increase initial intake and temporary storage of water and is useful in handling crop residue. Suitable methods of irrigation are the level-furrow, graded-furrow, sprinkler, and level-border methods.

CAPABILITY UNIT IIIe-3

This capability unit consists of deep, reddish-brown to dark yellowish-brown fine sandy loams that are gently sloping. These soils are:

Amarillo fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.
Portales fine sandy loam, 1 to 3 percent slopes.

These soils have moderate permeability and a moderate capacity to hold water and plant nutrients. They are susceptible to moderate wind erosion and moderate water erosion when they are cultivated. The Portales soil takes in water faster than the other soils in this group.

Cotton is the main cash crop. Other cash crops are grain sorghum and small grains, which supply residue that helps control erosion. Native grasses are also suited. Suitable crops under irrigation are alfalfa, vetch, Austrian winter peas, and cowpeas.

Dryland.—A crop that leaves large amounts of residue should be on these soils in about two-thirds of the acreage each year, or this kind of crop should be grown continuously. The residue should be left on the soil surface during critical periods to help control erosion and keep the soil in good condition. In years when inadequate amounts of residue are produced, chisel or list the soil so that the ground is left cloddy and rough. Occasionally plant a crop that increases fertility and productivity. Terraces and contour tillage conserve moisture and help control water erosion.

Irrigated.—A crop that improves the soil and leaves much residue should be kept on about one-half of the acreage each year. The residue should be handled so that it gives maximum soil protection and soil improvement. Perennial or biennial legumes and grasses can be included in the cropping system. Fertilizers may be applied as needed. Terraces and contour farming conserve moisture and help control water erosion. Sprinklers are best for the irrigation of these soils.

CAPABILITY UNIT IVe-1

The only soil in this capability unit is Amarillo fine sandy loam, 3 to 5 percent slopes. This is a deep, strongly sloping, brown to reddish-brown fine sandy loam. It is moderately permeable and has a moderate capacity to hold water and plant nutrients. It is susceptible to moderate wind erosion and severe water erosion.

This soil is suitable for only occasional cultivation between periods when the soil is kept in permanent vegetation. It is suited to grain sorghum and small grains, which are cash crops. Native grasses are also suited. Alfalfa can be grown under irrigation.

Dryland.—The cropping system should include grain sorghum or a small grain or another crop that leaves a large amount of crop residue. Stubble mulch the residue of these crops to protect the soil from wind erosion and water erosion. Occasionally plant a soil-improving crop, preferably one that leaves large amounts of residue; or seed perennial grasses with or without legumes. Terraces and contour tillage of cultivated crops are needed to reduce erosion and conserve moisture.

Irrigated.—Plant close-spaced crops that leave large amounts of residue and apply fertilizer; or seed perennial grasses with or without legumes. The grasses should be in a cropping system that includes an occasional annual crop. Leave crop residue on the surface, and stubble mulch this residue or handle it to prevent erosion during critical periods. Farm on the contour and use terraces to prevent erosion and conserve water. Irrigate with sprinklers.

CAPABILITY UNIT IVe-2 (IIIe-4, IRRIGATED)

This group consists of a light-gray to brown, moderately deep to deep loam and soils of varied texture. These soils are nearly level to gently sloping. They are:

Arch loam.
Drake soils, 1 to 3 percent slopes.

The hazard of water erosion is slight on the Arch soil and moderate on the Drake soils. Both are highly susceptible to wind erosion. They have a moderate capacity to store water. These soils contain large amounts of lime, which slows the release of plant nutrients and frequently causes the leaves of sorghum to turn yellow.

These soils are best suited to permanent vegetation. Grain sorghum, small grains, and sudangrass are grown. Under irrigation, cotton, alfalfa, sweetclover, vetch, Austrian winter peas, cowpeas and guar are suited.

Dryland.—The cropping system should include grain sorghum or small grains, or another crop that is close-growing and leaves large amounts of residue on the soil. The residue should be stubble mulched to provide maximum soil protection from wind erosion and water erosion. Seed perennial grasses, with or without legumes, in the cropping system. Terrace and contour farm sloping fields to reduce erosion and conserve moisture.

Irrigated.—Use a cropping system that, on about two-thirds of the acreage, provides crops that leave large amounts of residue. Preferably, these crops should be soil improving. Add commercial fertilizer to increase the amount of residue produced, and to maintain high yields. Deep-rooted legumes or grasses improve tilth and help maintain productivity. Leave the crop residue on the surface during critical periods of erosion hazards. Where feasible, terrace and contour farm to control erosion and conserve moisture. The most efficient way to irrigate these soils is by sprinklers.

CAPABILITY UNIT IVe-3 (IIIe-5, IRRIGATED)

In this group are deep, reddish-brown to dark-brown, moderately permeable loamy fine sands that are nearly level to gently sloping. They are:

Amarillo loamy fine sand, 0 to 3 percent slopes.
Spur loamy fine sand.

These soils are highly susceptible to wind erosion and, in some places, are moderately susceptible to water erosion. They have a low capacity for holding available water and plant nutrients.

If these soils are protected against wind erosion, they can be cultivated, but they are best suited to perennial vegetation. Native grasses do well. Grain sorghum, sudangrass, and small grains are the main crops. In some places, cotton is dry farmed, but this crop leaves the soil without cover much of the time. Alfalfa and sweetclover are grown successfully under irrigation. Other suitable irrigated crops are vetch, Austrian winter peas, and cowpeas.

Dryland.—If the land is successfully deep plowed, the cropping system should provide a crop that each year leaves large amounts of residue on about three-fourths of the acreage. Stripcropping protects the soil from erosion. Where the soil is not deep plowed, the cropping system should provide a continuous close-spaced crop that leaves a large amount of residue on the soil each year. The crop residue should be left on the surface and stubble mulched to retard erosion. In years when crop growth is inadequate, plant cover crops or catch crops that leave much residue and, if needed, use emergency tillage. If the moisture content is good, fertilizer may be added.

Irrigated.—A crop that provides a large amount of residue should be grown continuously on most of the land each year. Stubble mulch the crop residue on the surface to help control wind erosion. Where the soils have been successfully deep plowed, the cropping system should provide, on about one-half of the acreage each year, crops that leave large amounts of residue. The crop residue should be kept on the soil surface during critical periods of erosion hazard. If enough residue is not produced to control erosion, chisel or list the soil to control wind erosion. The use of fertilizer will increase crop yields.

CAPABILITY UNIT IVe-4 (IIIe-6, IRRIGATED)

This group consists of shallow, reddish-brown to brown fine sandy loams and loams that are nearly level to gently sloping. These soils are:

Arvana fine sandy loam, shallow, 0 to 3 percent slopes.
Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.
Mansker loam, 0 to 1 percent slopes.
Mansker loam, 1 to 3 percent slopes.

The fine sandy loams are moderately susceptible to wind erosion, and the loams are slightly susceptible. The soils that have slopes of 0 to 1 percent are slightly susceptible to water erosion, and the others are moderately susceptible. All of the soils of this group have a low to moderate capacity to hold water and plant nutrients and are moderately permeable. They are shallow and are often droughty, and they produce little residue.

These soils are best suited to permanent vegetation. Grain sorghum, sudangrass, and small grains are the main crops. Native grasses do well. Under irrigation, cotton, alfalfa, sweetclover, vetch, Austrian winter peas, guar, and cowpeas can be grown.

Dryland.—The cropping system should provide a closely spaced crop that produces much residue. This crop should be grown on these soils continuously. Leave the residue on the surface and stubble mulch to help control wind erosion. If these crops are also soil improving, they are useful in the cropping system. In years when inadequate amounts of residue are produced, till the soil to help control erosion.

Irrigated.—The cropping system should include, on about two-thirds of the acreage each year, a crop that leaves large amounts of residue on the soil, preferably one that is soil improving. The residue should be kept on the soil surface through the period when the erosion hazard is critical. Deep-rooted legumes or grasses improve the soil. Commercial fertilizer can be added to maintain high yields. Because they require small, frequent applications of water, irrigation is costly on these soils.

These soils can be irrigated by sprinklers or by a gravity method such as the level-border or the furrow method.

CAPABILITY UNIT IVe-5 (IIIe-7, IRRIGATED)

This group consists of reddish-brown to red, moderately permeable, sandy soils that are nearly level to gently sloping or undulating. They are:

Brownfield fine sand, thin surface.
Brownfield soils, moderately shallow.

These soils are highly susceptible to wind erosion, which is difficult to control. They have a low capacity to hold water and plant nutrients.

Grain sorghum is the main crop on these soils. Some cotton is grown, but it provides very little protective stubble. Areas that are planted to cotton, especially those under dry farming, are normally the areas where the soil first starts blowing away in spring. These soils are best suited to perennial grasses. Even if these soils receive adequate moisture, plant growth is limited by low fertility.

Dryland.—Close-spaced crops that produce large amounts of residue should be grown continuously. The residue should be left on the surface to help control wind erosion, particularly in critical periods. About three-fourths of the acreage each year should be in crops that produce large amounts of residue. If the residue is inadequate for control of wind erosion, use tillage to supplement the residue.

Irrigated.—Where these soils can be successfully deep plowed, each year about one-half the acreage should be in crops that produce large amounts of residue. These crops will improve the soil if they are adequately fertilized. Where deep plowing is not feasible, plant each year close-growing crops that return large amounts of residue to the soil. For greater protection, stubble mulch the residue. If not enough residue is produced to control wind erosion, till the soil to supplement the protection from residue.

CAPABILITY UNIT IVw-1

Randall fine sandy loam is the only soil in this capability unit. This soil is a brown to dark-brown fine sandy loam that occurs in beds of playas. It is weakly developed and poorly drained.

Wind and water from the higher lying soils have deposited materials on this soil. It is subject to occasional flooding but normally produces good crops. Because the areas of this soil are very small, they are generally not treated separately from the adjoining soils. Read the section "Use and Management of Rangeland" for more information on use and management of this soil.

CAPABILITY UNIT VIe-1 (IVe-6, IRRIGATED)

This group consists of a light-gray to brown fine sandy loam and soils with varied texture that have short slopes. These soils are:

Drake soils, 3 to 5 percent slopes.
Mansker fine sandy loam, 3 to 5 percent slopes.

These soils are highly susceptible to wind erosion and water erosion if they are cultivated. Unless irrigated, they should be kept in native grasses. Dry-farmed areas in cultivated crops should be reestablished in native grasses. Irrigated areas should include, in drilled or closely spaced rows, crops that leave large amounts of residue. Stubble mulch the residue to help control erosion. Sprinkler irrigation is best suited to these soils. For more information on use and management, read the section on range management.

CAPABILITY UNIT VIe-2 (IVe-7, IRRIGATED)

In this group are deep, yellowish-red to pale-brown loamy fine sands and fine sands that are nearly level to gently sloping. These soils are:

Brownfield fine sand, thick surface.
Gomez and Arch soils.

These soils are severely susceptible to wind erosion. They have a low capacity to hold water and plant nutrients and are moderately to rapidly permeable. Because the sandy surface layers of these soils are thick, deep plowing to increase the clay content of the surface soil is not practical.

These soils are not suited to dry-farmed cultivated crops, but they are suited to native grasses. If irrigated, and in drilled or closely spaced rows, grain sorghum, small grains, sudangrass, and perennial grasses have moderate yields.

Irrigated.—The cropping system should include, each year, a crop, in drilled or closely spaced rows, that produces large amounts of residue, preferably one that is soil improving. Stubble mulch the crop residue to help control wind erosion. Fertilize as needed to maintain production. The only suitable way to irrigate is by sprinklers.

CAPABILITY UNIT VIe-3

This capability unit consists of yellowish-red to brown loamy fine sands to loams that are nearly level to strongly sloping. These soils are shallow to very shallow and are moderately permeable. They are:

Arvana-Potter complex.
Brownfield soils, shallow.
Mansker-Potter complex.

These soils are severely susceptible to wind and water erosion. Because of their shallow depth, they are not suited to cultivation. Rangeland needs to be managed carefully to prevent erosion. Read the section on range management for more information on use and management of these soils.

CAPABILITY UNIT VIw-1

Randall clay is the only soil in this capability unit. This soil is gray to light brownish gray, weakly developed, and poorly drained. It occurs in playa beds and is frequently flooded by runoff from higher lying soils. It is only slightly susceptible to erosion, but the danger of flooding limits its use. Many of the small, shallow lakes are farmed during long, dry periods. Read the section on range management for information on use and management of this soil.

CAPABILITY UNIT VIIe-1

Drake soils, 5 to 30 percent slopes, is the only mapping unit in this capability unit. These are pale-brown to grayish-brown clay loams to fine sandy loams that are strongly sloping to steep. They are weakly developed and strongly calcareous.

These soils are highly susceptible to wind erosion and very highly susceptible to water erosion. Because they are strongly calcareous and steep, these soils are not suited to cultivation. They need careful management to control water erosion. For more information on their use and management, read the section on range management.

CAPABILITY UNIT VIIe-2

Tivoli fine sand is the only soil in this capability unit. This soil is pale brown to light yellowish brown, deep, and extremely sandy. Water intake is rapid, but the available water-holding capacity is low. Tall native grass, however, grows well. This soil is highly susceptible to wind erosion, and is not suited to cultivation. Read the section on range management for information on use and management of this soil.

CAPABILITY UNIT VIIe-3

Brownfield soils, severely eroded, are the only soils in this capability unit. These soils are yellowish-red to brown, deep, nearly level to gently sloping fine sands. They are moderately permeable. These soils are normally in abandoned fields that were once cultivated. They have been severely eroded by wind. They are highly susceptible to further wind erosion and are not suited to cultivation. Read the section on range management for information on use and management of these soils.

CAPABILITY UNIT VIIs-1

The only mapping unit in this capability unit is Potter soils. These soils are very shallow, grayish brown to brown, and calcareous. They are underlain by thick beds of soft or semihard caliche. Because they are very shallow and are on steep slopes, they are not suited to cultivation. Read the section on range management for information on use and management of these soils.

Estimated Yields

The yields of a soil reflect the quality of management the soil has had. If yields have been consistently high, the soil probably has been properly managed. In addition to keeping yields high, good management conserves the soil and may even improve it. The farmers of Terry County manage their soils at different levels of management. Consequently, the yields obtained vary from farm to farm.

In table 3 are estimated yields of cotton and grain sorghum on soils under low-level and high-level management. For soils that are both dry farmed and irrigated, yields are listed for both methods of farming. If only one method is practical, yields for this method are given.

Not included in table 3 are soils that are used only for range. Although many crops other than cotton and grain sorghum are grown in Terry County, yields for these crops are not listed, because the crops are grown in small acreages and reliable data on yields are not available.

The following describes the low-level and high-level management that is needed under dryland and irrigated farming—to obtain the estimated yields listed in table 3:

Low-level management—

Dryland:

1. Water is not properly conserved.
2. Soil-improving crops are not used in the cropping system.
3. Tillage alone is used to control wind erosion.

Irrigated:

1. Water is not properly conserved.
2. Irrigation is erratic.
3. Crop residues are plowed under.
4. Fertilization is haphazard or is not used.
5. Tillage alone is used to control wind erosion.

High-level management—

Dryland:

1. Rainfall on the land is conserved.
2. Soil-improving crops and high-residue crops are in the cropping system and are used to conserve moisture and to improve the soil.
3. Residue is used to help control wind erosion.

Irrigated:

1. Rainfall is saved and crops are watered according to need.
2. Fertilizers are used according to crop need, as determined by soil analyses.
3. Crop residue is used to help control wind and water erosion.
4. Soil-improving and high-residue crops are used in the cropping system.

Practically all farmers in the county use a high level of insect and weed control. As a rule, the farmers that practice the best general management get the best results in their control of insects and weeds.

Practices of Soil Management

The hazards in Terry County that the farmer tries to overcome are mainly the results of low and irregular rainfall, high winds, and wide fluctuations in temperature. He tries to offset these hazards by conserving the moisture, protecting the soil, improving its physical and biological condition, and maintaining its productivity.

Control of wind erosion

Wind erosion, or the blowing of soil by wind, is the greatest hazard to cultivation in the county. Its control is one of the main problems of soil management.

Wind erosion is a result of high winds striking loose, unprotected soil (fig. 9). The wind causes small soil particles of medium to fine sand to move in a series of bounces, or by rolling or creeping. Where these particles strike unprotected soil, they loosen other particles and free them so that they too can be carried by the wind. Some of the finer particles, such as silts and clays, are sometimes blown high into the air and may float for days before settling.

Soil can be protected from wind erosion by (1) surface cover or crop residue, (2) surface roughness, or (3) soil cloddiness, or by a combination of these means. The residue from grain sorghum or small grains and cover crops of winter peas, vetch, and small grains protect the soil by reducing the velocity of the wind near the soil surface. If the soil surface is rough, the velocity of the wind is also reduced and the first few soil particles to move are trapped.

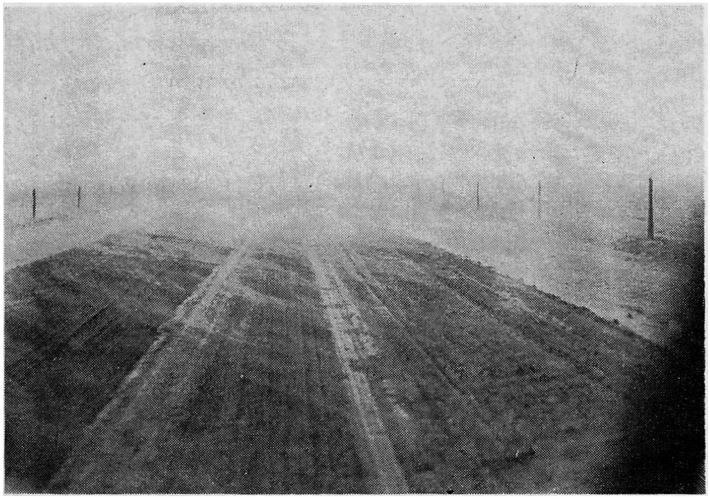

Figure 9.—**Soil moved by wind. The finer particles are lifted into the air and transported.**

Soil cloddiness is a form of surface roughness. The clods reduce susceptibility to wind erosion because those at the surface are too large to be moved by the wind. Clods are formed by clay and organic matter binding the sand and silt particles together. The amount of protection from erosion that clods give depends on the size, the stability, and the number of clods. The clods should be no smaller than an alfalfa seed, or about 0.84 millimeter (1/32 inch). Larger clods are more resistant to wind erosion than smaller ones.

Table 4 gives information that is helpful in comparing the erodibility of selected soils in Terry County. This table lists the weight of residue per acre needed to control wind erosion. In table 4 the texture of the 0- to 1-inch surface layer differs from the textural name of some of the soils listed because this layer may contain overblown material.

The finer textured soils have a larger percentage of their soil material in clods than the coarser ones and, therefore, tend to have less wind erosion. The relative erodibility of the soils can also be studied by comparing the weight of the residue that is needed on an acre of soil to control erosion. Generally, more residue is needed on the coarser textured soils. Table 4 also shows that the maximum soil loss per acre is greater on the sands than on the fine sandy loams when the minimum amount of protection is given by the surface roughness and residue.

TABLE 3.—*Estimated average yields of irrigated and dryland cotton and grain sorghum under low-level and high-level management on soils generally cultivated in Terry County, Texas*

Map symbol	Soil [1]	Low-level management				High-level management			
		Cotton lint		Grain sorghum		Cotton lint		Grain sorghum	
		Dry-land	Irri-gated	Dry-land	Irri-gated	Dry-land	Irri-gated	Dry-land	Irri-gated
		Lbs. per acre	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes	170	530	850	2, 100	225	1, 000	1, 200	5, 000
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes	140	500	700	1, 700	210	900	1, 000	4, 500
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes	100	400	500	1, 200	210	600	600	3, 000
AlA	Amarillo loam, 0 to 1 percent slopes	150	500	725	2, 000	210	950	1, 050	5, 100
AlB	Amarillo loam, 1 to 2 percent slopes	140	475	700	1, 700	200	900	975	4, 800
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes	150	550	700	1, 500	(2)	900	1, 000	4, 800
Ar	Arch loam	70	200	500	1, 300	(2)	500	700	3, 000
AvA	Arvana fine sandy loam, 0 to 1 percent slopes	150	475	850	2, 100	220	900	1, 150	4, 600
AvB	Arvana fine sandy loam, 1 to 3 percent slopes	120	400	700	1, 500	200	850	950	4, 300
AwB	Arvana fine sandy loam, shallow, 0 to 3 percent slopes	65	200	450	1, 200	(2)	400	600	3, 000
Bk	Brownfield fine sand, thick surface	75	350	600	1, 300	(2)	(2)	(2)	3, 500
Bn	Brownfield fine sand, thin surface	120	400	650	1, 500	165	850	900	4, 600
Br	Brownfield soils, moderately shallow	140	450	650	1, 500	180	900	900	4, 600
DrB	Drake soils, 1 to 3 percent slopes	60	180	600	1, 200	(2)	500	800	2, 800
DrC	Drake soils, 3 to 5 percent slopes	50	130	400	1, 000	(2)	(2)	(2)	2, 400
Ga	Gomez and Arch soils	80	350	500	1, 300	(2)	(2)	(2)	3, 000
MfA	Mansker fine sandy loam, 0 to 1 percent slopes	75	220	500	1, 300	(2)	450	750	3, 200
MfB	Mansker fine sandy loam, 1 to 3 percent slopes	65	200	450	1, 200	(2)	400	700	3, 000
MfC	Mansker fine sandy loam, 3 to 5 percent slopes	50	170	400	1, 000	(2)	(2)	(2)	2, 600
MlA	Mansker loam, 0 to 1 percent slopes	80	220	500	1, 400	(2)	500	750	3, 500
MlB	Mansker loam, 1 to 3 percent slopes	70	200	450	1, 300	(2)	450	700	3, 200
PfA	Portales fine sandy loam, 0 to 1 percent slopes	140	500	725	1, 800	200	1, 000	1, 100	5, 000
PfB	Portales fine sandy loam, 1 to 3 percent slopes	100	450	575	1, 600	190	900	900	4, 600
PlA	Portales loam, 0 to 1 percent slopes	125	500	650	2, 000	170	1, 000	1, 050	5, 200
Rf	Randall fine sandy loam	150	550	700	1, 500	(2)	800	1, 000	3, 500
Sc	Spur clay loam	160	600	750	2, 400	220	1, 000	1, 100	5, 200
Sf	Spur fine sandy loam	150	550	700	2, 200	210	1, 000	1, 050	5, 000
Sl	Spur loamy fine sand	140	520	675	2, 000	(2)	800	1, 000	4, 600
ZfA	Zita fine sandy loam, 0 to 1 percent slopes	180	600	900	2, 000	230	1, 000	1, 200	5, 000

[1] Soils used only for range in Terry County are not listed.

[2] Crop not recommended to be grown; soil has severe hazard of erosion or has other limitations.

TABLE 4.—*Percentage of soil material in clods greater than 0.84 millimeter, weight of residue required to control wind erosion, and maximum soil loss per acre for selected soils on the high plains in Texas* [1]

Soil type	Depth and thickness of layer	Texture (by field determination)	Clods greater than 0.84 mm.	Weight of residue required to control wind erosion [2]	Maximum soil loss per acre that has minimum roughness and residue
	Inches		*Percent* [3]	*Lb. per acre*	*Tons per acre*
Tivoli fine sand (one site)	0–1	Loamy fine sand	19. 4	1, 400	150
	1–6	Fine sand	4. 6	3, 000+	1, 600
Brownfield fine sand, thick surface (average of three sites).	0–1	Loamy fine sand	19. 0	1, 400	150
	1–6	Fine sand	15. 9	1, 600	240
Brownfield fine sand, thin surface [4] (average of three sites).	0–1	Loamy fine sand	21. 9	1, 200	110
	1–14	Loamy fine sand	14. 4	1, 400	150
	14–21	Sandy clay loam	87. 8	100	0
Portales fine sandy loam (average of two sites)	0–1	Fine sandy loam	31. 7	780	40
	1–10	Fine sandy loam	47. 2	440	12
Amarillo fine sandy loam (average of four sites)	0–1	Fine sandy loam	41. 0	600	20
	1–10	Fine sandy loam	56. 3	370	6

[1] From COOVER, JAMES R., and MOLDENHAUER, WILLIAM C., SOME CRITERIA FOR CAPABILITY CLASSIFICATION OF THE SOILS OF THE SOUTHERN GREAT PLAINS OF TEXAS. Soil Sci. Amer. Proc. 21:6, 1957 (*4*).

[2] On land untilled since last crop was grown.

[3] Percentage of soil material in clods greater than 0.84 millimeter across.

[4] Called Brownfield loamy fine sand in the paper cited.

Conservation cropping systems

Crops are in a conservation cropping system when they are grown in a rotation or sequence in which the good effects of soil-improving crops offset the bad effects of the soil-depleting crops. In Terry County the cropping system should include crops that provide maximum soil protection when the hazard of wind erosion is greatest. Although it is the most common cash crop, cotton does not adequately protect the soil during the critical period of wind erosion.

Before planning a conservation cropping system, a great deal about the soils of the area should be known. The limitations of a soil determine the kinds of crops grown and the frequency that these crops can be grown. The crops selected should (1) conserve the soil; (2) use available moisture efficiently; (3) protect the soil against wind and water erosion; (4) maintain or improve the physical condition, fertility, and biological condition of the soil; (5) aid in the control of weeds, insects, and disease and (6) fit into a long-time plan of land use and be economically sound and feasible.

As the hazard of erosion and other causes of soil deterioration increase, lengthen the time that you grow grasses, legumes, and other crops that produce large amounts of residue.

Use of crop residue

Crop residue and stubble left on the soil after a crop is harvested can be used to protect and improve the soil (fig. 10). This residue should be handled so that a protective cover is left on the surface during periods when the hazard of erosion is greatest. This is normally in fall, winter, and spring. The residue and stubble protect the soil from damaging winds and maintain or improve its physical, chemical, and biological condition.

The amount of crop residue needed to give minimum protection to the soil varies according to texture of the soil at the surface. Soils having a coarse texture at the surface need more crop residue than those having a fine texture.

Stubble mulching

Stubble mulching consists of tilling, planting, cultivating, and harvesting in such a way that large amounts of vegetation are left on the surface to protect the soil until the next crop is seeded. The crop is handled in such a way that a maximum amount of stubble and residue is produced and used for maximum protection and soil improvement. Stubble mulching helps control wind and water erosion; improves the physical, chemical, and biological condition of the soil; conserves moisture and reduces surface evaporation; and reduces the decline in organic matter that results from cultivation and cropping. This practice, however, requires the use of special equip-

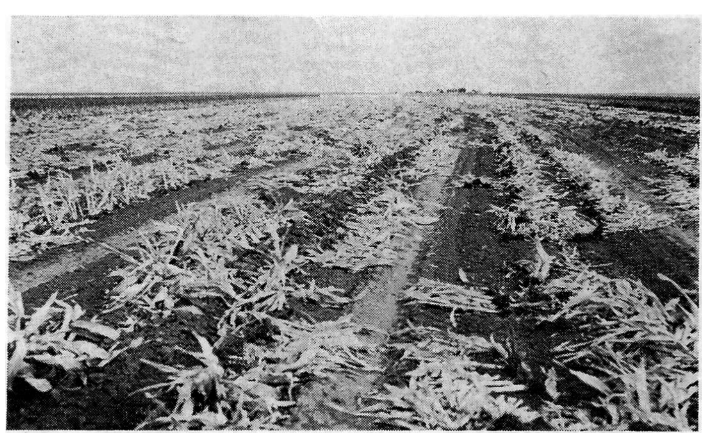

Figure 10.—Grain sorghum stubble left on the soil surface by using flat sweeps. This stubble will be left on the surface of the soil until about the first of April, or when a seedbed is prepared.

Figure 11.—**Planting in grain sorghum stubble by using a shallow furrow.**

ment to till, seed, and cultivate without plowing under the crop residues (fig. 11).

Farming on the contour and on terraces

In contour farming, the plowing, planting, and other cultivation are done by following level lines that are laid out so that level terraces and contour lines can be established. These lines are laid out so that the terraces and contours will impound as much water as possible.

Terraces are used to hold runoff water and spread (fig. 12) it in a way that makes a maximum amount of moisture available to plants. In Terry County much of the rain comes rapidly, sometimes 1 to 2 inches per hour. By using contour farming and terraces, much of the moisture is stored in the subsoil for future crops.

Farmstead windbreaks

Trees and shrubs planted to form a windbreak at farmsteads reduce the velocity of the wind around the farmstead. This prevents the sand from piling up and enables the farmer to keep a yard and garden and thus have a more pleasant place to live (figs. 13 and 14).

Figure 13.—**Sand blown from an unprotected field and accumulated around a farmstead.**

Specialists of the soil conservation district or other qualified woodland specialists will help you plan a windbreak system. They will suggest a plan for the spacing and the selection of trees or shrubs.

Deep plowing

Deep plowing is used to help protect the soil from blowing away (fig. 15). It is widely used in Terry County on soils that have a surface soil of fine sand and loamy fine sand. In deep plowing, 4 to 6 inches of the sandy clay loam subsoil is brought to the surface in the furrow slice. When this finer material is mixed with the sandy surface soil, the texture of the plow layer becomes fine sandy loam. The soil then can be roughened and made to form stable clods that are not blown away. If sandy erodible soils are dry-farmed, it is almost impossible to grow crops that leave enough residue on the soil surface to control wind erosion. After the soils are deep plowed, use a combination of crop residue, cloddiness, and roughness to control wind erosion. Deep plowing alone is not enough.

The clayey soil material that is brought up from below helps maintain a cloddier, less erodible structure so long as no soil drifting occurs. But if stability of the surface

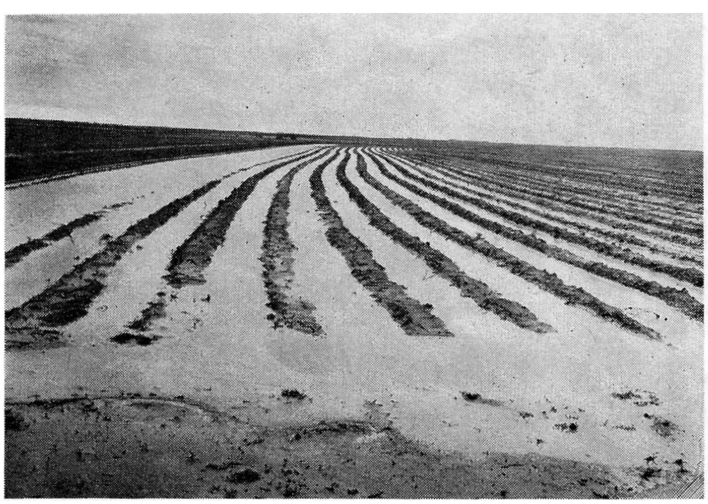

Figure 12.—**Water held on the field after a heavy rain.**

Figure 14.—**A farmstead protected by a well-established windbreak.**

Figure 15.—**A deep plow in operation, plowing Amarillo loamy fine sand, 0 to 3 percent slopes, to a depth of 18 inches.**

is not maintained after deep plowing, the benefits from the plowing are short lived. If soil continually drifts on areas that have been deep plowed, the clayey material will soon be out of reach of further deep plowing. The resulting deep mantle of sand may be a greater hazard than the initial shallower mantle (*3*).

Use of commercial fertilizer

The use of commercial fertilizer is new in Terry County. Formerly most cultivated land was dry farmed and fertilizer was not used; lack of moisture was the greatest limitation on most soils. Since 1949, irrigation has increased in the county. Farmers noticed that yields declined on irrigated soils after 3 or 4 years of cropping. In 1949, about 5,000 acres of irrigated cotton was fertilized. Results were favorable. By 1957, the area fertilized increased to about 100,000 acres.

Fertility tests in 1958 show that yields of cotton lint and grain sorghum increase where fertilizer is added to irrigated soil. In these tests, the yield of lint on unfertilized soil was 773 pounds per acre. The yield increased to 1,015 pounds per acre where 60 pounds of nitrogen was added; and to 1,126 pounds per acre where 120 pounds of nitrogen and 30 pounds of phosphoric acid were added. The yield was 1,113 pounds per acre where 60 pounds of nitrogen, 30 pounds of phosphoric acid, and 30 pounds of potash were added. The rates now suggested for cotton on irrigated soil are 40 to 80 pounds of nitrogen, 40 to 60 pounds of phosphoric acid, and 40 to 60 pounds of potash.

In the 1958 tests, yields of grain sorghum were 4,335 pounds per acre in unfertilized soil and 6,152 pounds per acre where 80 pounds of nitrogen and 40 pounds of phosphoric acid were added. The rates now suggested for irrigated grain sorghum are 80 pounds of nitrogen and 40 pounds of phosphoric acid per acre. If grain sorghum is fertilized, it is important that enough water is available. Otherwise, growth of the plants is not sufficient to obtain full benefit from the fertilizer applied.

The foregoing rates for use of fertilizer are general. Because soils vary in nutrient levels, test individual soils and apply fertilizer according to the results of the tests.

According to H. J. Walker, assistant agronomist at the Texas Agricultural Experiment Station, moderate additions of nitrogen and phosphate on dry land are profitable in years when rainfall is adequate and timely. This condition will probably occur 2 or 3 years in 5 years.

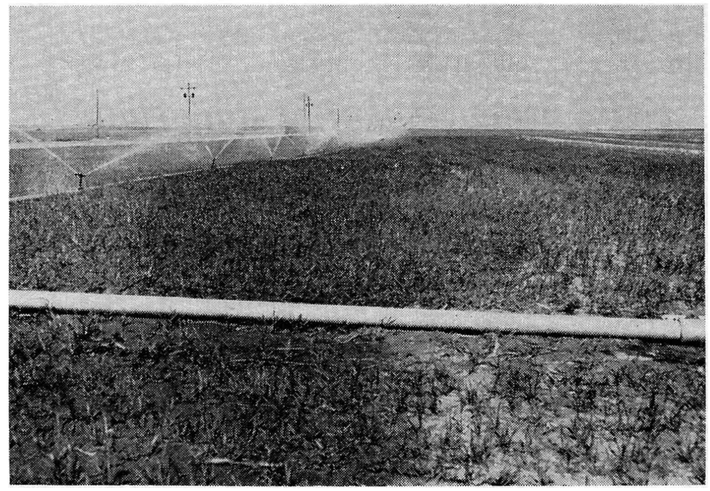

Figure 16.—**A sprinkler irrigating a fall planting of rye for a cover crop.**

Conservation irrigation

Conservation irrigation is fairly new in Terry County. From 1949 to 1958, the number of irrigation wells in the county increased from 65 to 1,200. These wells range from 65 to 210 feet in depth and can supply 80 to 1,000 gallons per minute. In 1959, approximately 136,000 acres of cropland and pasture were irrigated. Most of the irrigation water is in a belt 10 to 15 miles wide that extends from northwest to southeast across the county.

Most irrigation is by the sprinkler system (fig. 16), but in a few areas where the soils are nearly flat and are somewhat clayey, the flood-type system is used.

Conservation irrigation is important to the farmer because it saves water and makes crop production economical. Plan a system that:

1. Uses rainfall and irrigation water efficiently.
2. Improves or maintains soil productivity.
3. Controls erosion.
4. Prevents excess leaching of plant nutrients.
5. Disposes of excess water without causing significant erosion.
6. Prevents waterlogging or accumulation of harmful salts.
7. Provides uniform stands of crops.
8. Provides uniform growth of crops before maturity.
9. Provides maximum crop production.
10. Maintains a high level of moisture at all times.

It is most important to maintain or increase soil productivity. Unless the soil is managed well, the best system for control and distribution of water will not be successful.

Among the things that must be considered in designing a system for conservation irrigation are:

1. The quality and quantity of available water.
2. The rate the soil takes in water and the amount of water the soil will hold.
3. The amount of water needed by the crops grown.
4. The topography of the land.

Engineers in the Soil Conservation Service will help you design a conservation irrigation system that is suited to your soils, water supply, and selected crops.

Use and Management of Rangeland [3]

The production of livestock is the second largest agricultural enterprise in the county. Its success depends on the way ranchers manage their rangeland. Much of the rangeland in the county is now producing only one-fourth or less of the forage it normally produces when the range is in good or excellent condition.

Approximately 91,000 acres in Terry County is rangeland. About 50,000 acres of this rangeland is in large areas on deep sands and shallow soils that, when properly managed, produce good forage. About 41,000 acres is in smaller areas near fields where cultivated crops are grown.

The rangeland on sandy soils was originally in giant dropseed, side-oats grama, and some shin oak. A good stand of side-oats grama and black grama was on the shallow soils. Because of overuse, selective grazing, and general neglect, undesirable plants have replaced palatable grasses. Shin oak has replaced the tall and mid grasses on the sandy soils, and mesquite and other woody plants have replaced the mid and short grasses on the shallow soils.

The 41,000 acres of rangeland in the more productive areas is still in native grass. This rangeland is made up of almost all kinds of soils in the county. It once supported an almost pure stand of mid and short grasses, but it is now heavily invaded by mesquite. The individual areas are small and adjoin fields where cultivated crops are grown.

Principles of Range Management

Good range management increases the palatable native plants in the forage and conserves soil and water as well. The grazing should be regulated so that grass can grow and reproduce and provide maximum yields for grazing animals. The essential stages in the growth and reproduction of grass are the development of leaves, the growth of roots, the formation of flower stalks, the production of seeds, the regrowth of forage plants, and the storage of food in roots.

Livestock graze selectively; they constantly seek the more palatable and more nutritious plants. If grazing is not carefully regulated, the plants that livestock prefer decrease or are eliminated and less desirable, or second-choice, plants increase. The preferred plants that decrease are called *decreasers*, and the less desirable plants that increase are called *increasers*. If grazing continues, even the less desirable plants, or increasers, are thinned out or are eliminated and undesirable weeds, called *invaders*, replace them.

Research and the experience of ranchers show that damage to the better plants is minimized and the range condition improves when about half the yearly volume of grass produced is grazed. The forage left on the ground does these things:

1. Serves as a mulch that causes rapid intake and storage of water. The more water stored in the ground, the better the grass grows.
2. Permits roots to reach deep moisture. Grass that is heavily grazed cannot reach deep moisture because not enough green shoots are left to provide the food needed for good growth of roots.
3. Protects the soil from wind and water erosion. Grass is the best cover for protection of soil against erosion.
4. Permits the better grasses to crowd out weeds.
5. Enables plants to store food for rapid and vigorous growth after droughts and in spring.
6. Provides a greater reserve of food that can be used in dry spells and prevents the sale of underweight livestock at a loss.

Sound range management requires that, from season to season, grazing be kept in balance with the growth of forage. Reserve pastures or other feed for livestock should be provided during droughts or in other periods when the production of forage is low. This permits a moderate use of forage at all times. It is often desirable to keep some livestock such as stocker steers, that can be sold easily. The rancher can then keep the number of livestock in balance with the available forage without selling breeding animals at a loss.

Range Sites

Different kinds of rangeland produce different kinds and amounts of grass. In order to manage rangeland properly, a rancher should know the different kinds of soil on his ranch and the plants that will grow on each soil. Then he can use management that will produce the best forage plants.

A range site is a kind of rangeland that differs significantly from other rangeland in its capacity to produce different kinds and amounts of climax, or original, vegetation. The difference between two range sites must be enough to require different use and management on the sites to maintain or improve the grasses. The climax vegetation of a range site is that combination of plants that originally grew on the site. Generally, it is the most productive combination of forage plants that will grow on the site.

The condition of a range is judged by comparing the existing vegetation with the climax vegetation. There are four classes of range condition—*excellent, good, fair*, and *poor*. Any range that has 75 percent or more of its climax vegetation is in *excellent* condition. A range that has 50 to 75 percent of its climax vegetation is in *good* condition; one that has 25 to 50 percent is in *fair* condition; and one having less than 25 percent is in *poor* condition.

A rancher can estimate the condition of the range if he knows the composition of the climax vegetation. If soils are placed in range sites, the grasses can be named that make up the climax vegetation in each range site. Then the rancher can determine the condition of his range by comparing the existing vegetation with the climax vegetation.

The eight range sites in Terry County are (1) Bottom Land, (2) Sand Hill, (3) Sandy Land, (4) Sandy Flat, (5) Mixed Land, (6) High Lime, (7) Deep Hardland, and (8) Shallow Land.

Four or five grasses are generally dominant when a range site is in excellent condition. On the Sand Hill range site, for example, sand bluestem, giant dropseed, giant sandreed, and little bluestem make up more than 60 percent of the total forage when the range is in excellent condition. The site, therefore, is producing nearly its maximum amount of forage when these grasses are

[3] This section written by ALTON T. WILHITE, JR., range conservationist, Soil Conservation Service.

dominant. Many other grasses grow on the Sand Hill range site, but they are in small amounts. If the grasses on a range site are similar in kind and in proportions to those in the climax vegetation, the range site will probably produce high yields for a long time.

In the discussions of the range sites that follow, the annual production of forage is based on a 3-year study.

BOTTOM LAND RANGE SITE

This range site occurs in narrow draws that are in flats or in nearly level areas. It receives runoff water from adjoining range sites, even when the rainfall is light. This range site consists of the following soils:

Spur clay loam.
Spur fine sandy loam.
Spur loamy fine sand.

The climax vegetation of this range site consists of 60 to 70 percent decreasers and 30 to 40 percent increasers. The decreasers are mostly side-oats grama, cane bluestem, silver bluestem, white tridens, and plains bristlegrass. The increasers are mostly vine mesquite, blue grama, and buffalograss. Common invaders are mesquite and annuals.

If rainfall is normal and the range is in good condition, this site produces annually 3,000 to 3,500 pounds of forage (dry weight) per acre.

SAND HILL RANGE SITE

This range site consists of large sand dunes and lower lying level to gently sloping areas between the dunes. The dunes are as much as 20 feet high and have choppy slopes of about 40 percent. Many blowout spots are on the southwest side of the dunes. The soils are very sandy, and there is no runoff. This range site consists of the following soils:

Brownfield fine sand, thick surface.
Brownfield soils, severely eroded.
Tivoli fine sand.

The climax vegetation consists of 60 to 70 percent decreasers and 30 to 40 percent increasers. The decreasers are mostly sand bluestem, giant dropseed, giant sandreed, and little bluestem. The increasers are mainly sand dropseed, perennial three-awn, and Havard oak. Common invaders are false buffalograss and annuals.

If rainfall is normal and the range is in good condition, this site produces annually 2,000 to 2,300 pounds of forage (dry weight) per acre.

SANDY LAND RANGE SITE

This range site is undulating and normally occurs on nearly level to gently sloping plains. Because the soils are sandy, they readily take in water and there is very little runoff. No drainage patterns are formed. This range site consists of the following soils:

Amarillo loamy fine sand, 0 to 3 percent slopes.
Brownfield fine sand, thin surface.
Brownfield soils, moderately shallow.

The climax vegetation consists of 65 to 75 percent decreasers and 25 to 35 percent increasers. The decreasers are mainly giant dropseed, little bluestem, side-oats grama, mesa dropseed, and plains bristlegrass. The increasers are mainly hooded windmillgrass, fall witchgrass, sand dropseed, perennial three-awn, and Havard oak. The common invaders are annuals.

If rainfall is normal and the range is in good condition, this site produces annually 1,550 to 1,750 pounds of forage (dry weight) per acre.

SANDY FLAT RANGE SITE

The only mapping unit in this range site is Gomez and Arch soils. The range site generally is in nearly level, slight depressions within much larger areas of Brownfield soils. The depressions receive runoff from surrounding areas. In a few places this range site makes up broad expanses of gently sloping, undulating plains.

The climax vegetation on this site consists of 65 to 75 percent decreasers and 25 to 35 percent increasers. The decreasers are mainly side-oats grama, cane bluestem, silver bluestem, blue grama, plains bristlegrass, and Arizona cottontop. The increasers are mainly black grama, hooded windmillgrass, sand dropseed, and perennial three-awn. Common invaders are sand sage and annuals.

If rainfall is normal and the range is in good condition, this site produces annually 1,700 to 1,900 pounds of forage (dry weight) per acre.

MIXED LAND RANGE SITE

This range site normally occurs on broad areas of nearly level to gently sloping soils on uplands. Drainage patterns are immature, and most of the drainage is in shallow playas. This site consists of the following soils:

Amarillo fine sandy loam, 0 to 1 percent slopes.
Amarillo fine sandy loam, 1 to 3 percent slopes.
Amarillo fine sandy loam, 3 to 5 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, shallow, 0 to 3 percent slopes.
Zita fine sandy loam, 0 to 1 percent slopes.

The climax vegetation consists of 65 to 75 percent decreasers and 25 to 35 percent increasers. The decreasers are mainly side-oats grama, cane bluestem, silver bluestem, blue grama, Arizona cottontop, and plains bristlegrass. The increasers are mainly black grama, buffalograss, hooded windmillgrass, and sand dropseed. Common invaders are mesquite and annuals.

If rainfall is normal and the range is in good condition, this site produces annually 1,900 to 2,100 pounds of forage (dry weight) per acre.

HIGH LIME RANGE SITE

This range site occurs in two definite topographic positions, both related to ancient lake beds. One position is the nearly level floors of old lakes. The other is the convex, sloping, eolian dunes on the east and northeast side of the large playas.

This range site consists of the following soils:

Arch loam.
Drake soils, 1 to 3 percent slopes.
Drake soils, 3 to 5 percent slopes.
Drake soils, 5 to 30 percent slopes.
Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker loam, 0 to 1 percent slopes.
Portales fine sandy loam, 0 to 1 percent slopes.
Portales fine sandy loam, 1 to 3 percent slopes.
Portales loam, 0 to 1 percent slopes.

The Drake soils occur on the dunes on the east and northeast sides of the large playas. Runoff is high on the Drake soils during intense rains. The Arch and Portales soils are on the nearly level floors of the old lakes. Small areas of Arch and Portales soils may be flooded for a few hours following rains. The Mansker soils are surrounded by large areas of other soils in this range site.

The climax vegetation consists of 65 to 75 percent decreasers and 25 to 35 percent increasers. The decreasers are mainly side-oats grama, cane bluestem, silver bluestem, blue grama, and vine mesquite. The increasers are mainly black grama, sand dropseed, and perennial three-awn. Common invaders are sand muhly, ring muhly, ear muhly, and annuals.

Because of erosion and salinity, climax vegetation differs in some areas around salt lakes. Since salinity normally varies in these areas, the vegetation varies. There may be only salt-tolerant vegetation adjacent to the lakes, but as the distance from the lakes increases, the vegetation present is less tolerant of salt.

If rainfall is normal and the condition of the range is good, this site produces annually 1,600 to 1,800 pounds of forage (dry weight) per acre.

DEEP HARDLAND RANGE SITE

This range site normally occurs on nearly level to gently sloping plains. Drainage on this site is generally into large playas. This range site consists of the following soils:

Amarillo loam, 0 to 1 percent slopes.
Amarillo loam, 1 to 2 percent slopes.
Randall clay.
Randall fine sandy loam.

The climax vegetation consists of 55 to 65 percent decreasers and 35 to 45 percent increasers. The decreasers are mainly side-oats grama, blue grama, cane bluestem, silver bluestem, and vine mesquite. The increasers are mainly tobosa, buffalograss, and perennial three-awn. Common invaders are mesquite and annuals.

If rainfall is normal and the condition of the range is good, this site produces annually 1,500 to 1,600 pounds of forage (dry weight) per acre.

SHALLOW LAND RANGE SITE

This range site consists of shallow soils. It occurs throughout the county. It may be among large areas of deep soil or it may occur on slopes that grade into ancient draws in high plains. This range site consists of the following soils:

Arvana-Potter complex.
Brownfield soils, shallow.
Mansker fine sandy loam, 1 to 3 percent slopes.
Mansker fine sandy loam, 3 to 5 percent slopes.
Mansker loam, 1 to 3 percent slopes.
Mansker-Potter complex.
Potter soils.

The climax vegetation consists of 70 to 75 percent decreasers and 25 to 30 percent increasers. The decreasers are mainly side-oats grama, black grama, cane bluestem, silver bluestem, and New Mexico feathergrass. The increasers are mainly hairy grama, slim tridens, sand dropseed, and perennial three-awn. Common invaders are broom snakeweed and annuals.

If rainfall is normal and the condition of the range is good, this site produces annually 1,000 to 1,200 pounds of forage (dry weight) per acre.

Practices of Range Management

Grazing ought to be regulated so that adequate protective cover and the most desirable grasses are maintained. If the range has deteriorated, the intensity of grazing should be lessened or grazing should be deferred so the the quality and quantity of the grasses are improved.

Keep the number of livestock in balance with the amount of forage produced. This can be done by regulating the grazing according to the quantity and quality of key grazing plants. The condition of the range can be judged by observing these plants. The key plants are generally the most palatable ones. They make up 10 percent or more of the vegetation.

To get the most from forage plants—

1. See that enough leaf and stem growth is left for the manufacture of plant food.
2. Regulate grazing during the early development of plants to permit accumulation and storage of plant foods. Close grazing decreases the yields and reduces the root growth of most plants and may eventually eliminate the desirable ones.
3. Consider the characteristics of all plants in the range vegetation to determine how much forage is available, when it is ready to be grazed, and how long it should be grazed.

Generally, it is considered safe to permit animals to graze about 50 percent of the total volume of the current growth of a plant. This means that 50 percent of the growth of the key plants can be removed. It does not mean that 50 percent of the total forage production can be removed. When the key plants are grazed properly, 75 to 90 percent of the less palatable plants may be left. Grazing has been regulated properly if, at the end of the grazing season, a stubble 1½ to 2 inches high is left for short grasses, 4 to 7 inches for mid grasses, and 7 to 10 inches for tall grasses.

Much of the rangeland in Terry County is in fair or poor condition. The grazing on this rangeland should be deferred so that the vigor of the forage stand is increased. When grazing is deferred, the most desirable plants produce seed, reproduce, and grow free from grazing pressure. The time to defer grazing depends on the season of growth and the period of seed development for the desirable plants.

On most farms and ranches, it is not practical to defer grazing on all ranges in the same year. Parts of the rangeland can be rested while other parts are being grazed. Over a period of years, all the rangeland benefits from rests during the growing season. As the more palatable plants increase in number, their vigor and condition improve and the available forage increases.

Because animals eat the seedstalks and flowers of the key grasses and allow the poorer grasses to increase, keep all livestock off the range during the rest period. If parts of the rangeland are overgrazed while other parts are being rested, the benefits gained from the rest are lessened.

Following are some important practices of range management needed in Terry County and discussions of these practices:

1. Range seeding. Ranges in poor condition need seeding to perennial grasses or improved grasses so that losses of soil and water are prevented. Rangeland should be seeded if the desirable grasses are so depleted that they cannot reseed and spread naturally and thereby check erosion and allow water to enter the soil. A range needs reseeding if there is less than 10 percent of the climax

vegetation on the range. Cropland in the county also needs to be seeded to grasses if erosion cannot be otherwise controlled.

2. Brush control. Brush ought to be controlled on range sites where it suppresses the growth of grasses so much that the grasses give no protection from erosion and do not supply satisfactory forage. Some areas in the county need to have the brush controlled before the condition of the range can be improved. The brush should be controlled if it makes up more than 10 percent of the total vegetation. It can be controlled by chemical or mechanical means. Mesquite and Havard oak are particularly troublesome in Terry County.

3. Water distribution. Points where water is available to livestock should be close enough so that the animals do not have to walk far for a drink. For cattle, reasonable spacing of these points is 1 mile on sandy areas and 2 miles in smooth flat areas. Well-spaced watering points will help to keep the range grazed evenly. Most ranges in Terry County have adequate wells, which are the only source of water for livestock on ranges.

4. Fencing. Most of the rangeland in Terry County is adequately fenced for the control of livestock and for the regulation of grazing. Additional cross fences could be built within some fenced areas to permit deferred and seasonal grazing.

Engineering Applications [4]

Engineers can use the information in the report to:—

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

This section and other parts of this report, however, do not contain enough information to enable the engineer to omit sampling and testing the soils at the construction site and at other places where soil is taken for use in structures. Most of the information in this section is in tables 5, 6, and 7.

[4] This section was written by LEE H. WILLIAMSON, engineer, Soil Conservation Service.

Soil Science Terminology

Some of the terms used by soil scientists may be unfamiliar to the engineer, and some words, such as soil, clay, silt, sand, aggregate, and granular structure, may have special meanings in soil science. A few terms commonly used by soil scientists are defined as follows:

Soil: The natural medium for the growth of land plants on the surface of the earth; composed of organic and mineral materials.

Clay: A soil particle or size group of mineral particles less than 0.002 millimeter in diameter; a textural class that has soil material containing 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Silt: A soil particle ranging from 0.05 to 0.002 millimeter in diameter; a textural class that has soil material containing 80 percent or more silt and less than 12 percent clay.

Sand: A soil particle ranging from 2.0 to 0.05 millimeter in diameter; a textural class that has soil material containing 85 percent or more of sand and not more than 10 percent of clay.

Aggregate: A cluster of primary soil particles held together by internal force to form a clod or fragment.

Granular structure: Individual grains grouped into spherical aggregates that have indistinct sides. Highly porous granules are commonly called crumbs.

pH: An index value that indicates the acidity or alkalinity of the soil. It is an index of the free hydrogen-ions in the soil. A pH value of 7.0 is considered to be neutral. Values less than 7.0 indicate acid soils and greater than 7.0, alkaline soils.

Surface soil: The soil ordinarily moved by tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness.

Subsurface soil: That part of the A horizon below the surface soil.

Subsoil: The B horizon of soils with distinct profiles. In soils with weak profile development, it is the soil beneath the surface soil in which roots normally grow.

Soil texture: The relative proportions of sand, clay and silt in a soil.

Structure: The aggregates in which the individual soil particles are arranged. Structure is indicative of drainage characteristics.

Engineering Description of Soils

Table 5 gives an engineering description of the soils in Terry County and an estimate of physical properties that are important in engineering.

The soil material in the horizons of a typical profile for each soil type is classified in three systems—USDA, Unified, and AASHO. The USDA system is the textural classification used by the Soil Conservation Service in soil surveys.

The Unified classification was established by the Vicksburg Waterways Experiment Station of the Corps of Engineers, U.S. Army. In this system soil material is put in 15 classes that are designated by pairs of letters. These classes range from GW, which consists of well-graded gravel, gravel and sand mixtures, and a little fine material to Pt, which consists of peat and other highly organic, soils.

Many highway engineers classify soil material according to the AASHO method. This method was adapted by the American Association of State Highway Officials. In this system, soil materials are classed in seven principal groups. The groups range from A–1, consisting of soils that have high bearing capacity, to A–7, consisting of clayey soils having low strength when wet.

TABLE 5.—*Engineering description and estimated*

Map symbol	Soil name	Soil description	Depth from surface in typical profile	Classification	
				USDA	Unified [1]
			Inches		
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes.	8 to 14 inches of fine sandy loam overlying 30 to 40 inches of moderately permeable, well-drained sandy clay loam; developed on unconsolidated moderately sandy alluvial and eolian sediments.	0–10	Fine sandy loam	SM
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes.		10–46	Sandy clay loam	SC or CL
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes.		46–72	Sandy clay loam	SC or CL
AlA	Amarillo loam, 0 to 1 percent slopes.	4 to 9 inches of loam overlying 24 to 36 inches of moderately permeable, well-drained clay loam subsoil; developed on unconsolidated moderately sandy alluvial and eolian sediments.	0–8	Clay loam	CL
AlB	Amarillo loam, 1 to 2 percent slopes.		8–36	Clay loam	CL
			36–72	Clay loam	CL
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes.	9 to 20 inches of loamy fine sand overlying 24 to 36 inches of moderately permeable well-drained sandy clay loam; developed on unconsolidated moderately sandy alluvial and eolian sediments.	0–11	Loamy fine sand	SM
			11–46	Sandy clay loam	SM or SC
			46–84+	Sandy clay loam	SC
Ar	Arch loam.	6 to 8 inches of well-drained, strongly calcareous loam; developed from chalky earths that consist of old alluvium or plains outwash; apparently modified by calcium carbonate deposited by ground water; occupies broad valleys and benches around intermittent lakes on the southern high plains.	0–10	Clay loam [5]	CL [5]
			10–14	Clay loam [5]	CL [5]
			14–40	Clay loam [5]	CL [5]
AvA	Arvana fine sandy loam, 0 to 1 percent slopes.	8 to 12 inches of fine sandy loam overlying 14 to 26 inches of moderately permeable, well-drained sandy clay loam; developed on a thin, sandy, eolian mantle deposited over indurated caliche.	0–12	Fine sandy loam [5]	SM [5]
AvB	Arvana fine sandy loam, 1 to 3 percent slopes.		12–22	Sandy clay loam [5]	SC or SM [5]
			22+	Hard caliche	
Bk	Brownfield fine sand, thick surface.	20 to 40 inches of fine sand overlying 20 to 30 inches of well-drained, moderately permeable sandy clay loam; developed from sandy earth that appears to be eolian; in some places hard caliche is at depths of 3 to 7 feet.	0–27	Loamy fine sand	SM
			27–52	Sandy clay loam	SC
			52–60+	Fine sandy loam	SM
Bn	Brownfield fine sand, thin surface.	12 to 16 inches of fine sand overlying 20 to 30 inches of well-drained, moderately permeable sandy clay loam; developed from sandy earth that appears to be eolian; in some places hard caliche is at depths of 3 to 7 feet.	0–16	Loamy fine sand	SM
			16–56	Sandy clay loam	SC
			56–74+	Fine sandy loam	SC
Br	Brownfield soils, moderately shallow.	12 to 16 inches of fine sand overlying 20 to 30 inches of well-high drained, moderately permeable sandy clay loam; developed from sandy earth that appears to be eolian; in some places hard or soft caliche is at 20 to 36 inches.	0–11	Loamy fine sand [5]	SM
Bs	Brownfield soils, shallow.		11–33	Sandy clay loam [5]	SC, SM, or ML.
Bt3	Brownfield soils, severely eroded.		33+	Hard or soft caliche.	
DrB	Drake soils, 1 to 3 percent slopes.	6 to 12 inches of strongly calcareous, well-drained fine sandy loam; developed from eolian deposits from playas in the southern high plains.	0–9	Clay loam [5]	CL [5]
DrC	Drake soils, 3 to 5 percent slopes.		9–31	Clay loam [5]	CL [5]
DrE	Drake soils, 5 to 30 percent slopes.		31+	Clay loam [5]	CL [5]
Ga	Gomez loamy fine sand.[7]	12 to 20 inches of loamy fine sand overlying 8 to 20 inches of well-drained, slightly more clayey material; underlain by strongly calcareous sandy material that may be saturated with water during periods of high rainfall.	0–14	Loamy fine sand [5]	SM [5]
			14–24	Fine sandy loam [5]	SM or ML [5]
			24–60	Caliche	A–2 or A–4

See footnotes at end of table.

physical properties of soils in Terry County, Tex.

Classification—Con.	Percent passing sieve			Permeability	Structure	Available moisture-holding capacity	pH	Shrink-swell potential
AASHO [2]	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)					
				Inches per hr.		*Inches per foot*		
A-2	[3] 27-55	[3] 100	[3] 100	1. 0-2. 0	Structureless to weak, subangular blocky.	1. 5	7. 5-7. 8	Low to moderate.
A-4 or A-6	[3] 35-55	[3] 100	[3] 100	0. 5-1. 0	Moderately coarse, prismatic and weak, subangular blocky.	1. 9	7. 5-8. 0	Low to moderate.
A-2, A-4, or A-6.	[4] 25-70	[4] 95-100	[4] 95-100	0. 5-1. 0		0. 5	8. 0-8. 4	Low to moderate.
A-6	[4] 65-70	[4] 100	[4] 100	0. 5-1. 5	Weak, subangular blocky and granular.	1. 9	7. 1-7. 6	Low to moderate.
A-6	[4] 65-76	[4] 100	[4] 100	0. 5-1. 5	Moderate, prismatic and weak, subangular blocky.	1. 9	7. 6-7. 9	Moderate to low.
A-6	[4] 63-81	[4] 97-100	[4] 93-100	0. 5-1. 5	----------	0. 5	7. 9-8. 1	Low.
A-2	[3] 18-20	[3] 100	[3] 100	1. 5-5. 0	Structureless	1. 0	7. 2-7. 7	Low.
A-2 or A-6	[3] 30-38	[3] 100	[3] 100	0. 5-1. 5	Moderate, coarse, prismatic or weak, subangular blocky.	1. 9	7. 5-8. 0	Low to moderate.
A-2, A-4, or A-6.	[3] 30-39	[3] 100	[3] 100	0. 5-1. 5	----------	0. 5	8. 0-8. 5	Low to moderate.
A-4 [5]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Structureless to weak, subangular blocky.	2. 1	8. 0+	Moderate.
A-6 [5]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A-6 [6]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A-2-4 [5]	[6] 15-57	[6] 43-85	[6] 100	1. 0-2. 0	Structureless to weak, subangular blocky.	1. 5	7. 5-7. 8	Low to moderate.
A-2-4 or A-6.[5]	[6] 20-55	[6] 45-80	[6] 100	0. 5-1. 5	Moderate, prismatic and weak, subangular blocky.	1. 9	7. 5-7. 8	Low to moderate.
----------	----------	----------	----------	----------	----------	0. 5	8. 0+	Low.
A-2	[3] 15-20	[3] 100	[3] 100	5. 0+	Structureless	0. 7	7. 5	Low.
A-2	[3] 25-40	[3] 100	[3] 100	0. 5-1. 5	Moderate, prismatic and weak, subangular blocky.	1. 9	7. 2-7. 8	Low to moderate.
A-2	[3] 25-40	[3] 100	[3] 100	1. 0-2. 0	Weak, subangular blocky	1. 5	7. 2-8. 0	Low to moderate.
A-2	[4] 15-20	[4] 100	[4] 100	5. 0+	Structureless	0. 7	7. 6	Low.
A-6	[4] 35-40	[4] 100	[4] 100	0. 5-1. 5	Moderate, prismatic and weak, subangular blocky.	1. 9	7. 2-7. 9	Low to moderate.
A-6	[4] 35-40	[4] 100	[4] 100	1. 0-2. 0	Weak, subangular blocky	1. 5	7. 2-8. 3	Low to moderate.
A-2	[6] 10-30	[6] 70-90	[6] 100	1. 5-5. 0	Structureless	1. 0	7. 2-7. 7	Low.
A-2, A-4, or A-6.	[6] 20-55	[6] 45-80	[6] 100	0. 5-1. 5	Moderate, prismatic and weak, subangular blocky.	1. 9	7. 4-7. 9	Low to moderate.
----------	----------	----------	----------	----------	----------	0. 5	8. 0+	Low.
A-4 [5]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Weak, subangular blocky	2. 1	8. 0+	Moderate.
A-6 [5]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A-6 [5]	[6] 55-80	[6] 20-45	[6] 100	0. 2-0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A-2	[6] 10-30	[6] 70-90	[6] 100	1. 5-5. 0	Structureless	1. 0	7. 2-7. 8	Low.
A-2 or A-4	[6] 15-55	[6] 45-85	[6] 100	1. 0-2. 0	Weak, subangular blocky	1. 5	7. 5-8. 0+	Low to moderate.
----------	[6] 20-55	[6] 45-80	[6] 100	0. 5-1. 5	----------	0. 5	8. 0+	Low to moderate.

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TABLE 5.—*Engineering description and estimated*

Map symbol	Soil name	Soil description	Depth from surface in typical profile	Classification	
				USDA	Unified [1]
			Inches		
MfA	Mansker fine sandy loam, 0 to 1 percent slopes.	12 to 22 inches of fine sandy loam overlying medium- to fine-textured sediments underlain by strongly calcareous sandy material that may be saturated with water during periods of high rainfall.	0–7	Fine sandy loam [5]	SM or ML [5]
MfB	Mansker fine sandy loam, 1 to 3 percent slopes.		7–18	Sandy clay loam [5]	SC or ML [5]
MfC	Mansker fine sandy loam, 3 to 5 percent slopes.		18–50+	Sandy clay loam [5]	SC or ML [5]
MlA	Mansker loam, 0 to 1 percent slopes.	12 to 22 inches of well-drained loam to clay loam developed from strongly calcareous, medium- to fine-textured sediments of high plains outwash material; occurs on high plains and rolling plains.	0–5	Clay loam	CL
MlB	Mansker loam, 1 to 3 percent slopes.		5–14	Clay loam	CL
			14–30+	Clay loam	CL
PfA	Portales fine sandy loam, 0 to 1 percent slopes.	24 to 36 inches of well-drained fine sandy loam developed from strongly calcareous, medium- to fine-textured sediments of high plains outwash material; occurs on high plains and rolling plains.	0–10	Fine sandy loam	SM or CL
PfB	Portales fine sandy loam, 1 to 3 percent slopes.		10–25	Sandy clay loam	SC or CL
			25–60+	Sandy clay loam	SC or CL
PlA	Portales loam, 0 to 1 percent slopes.	24 to 36 inches of calcareous, well-drained, moderately permeable loam to clay loam developed in limy plains sediments; underlain by a thick layer of whitish, soft caliche.	0–17	Clay loam [5]	CL [5]
			17–24	Clay loam [5]	CL [5]
			24–35	Clay loam [5]	CL [5]
Ps	Potter soils.	2 to 10 inches of strongly calcareous, well-drained fine sandy loam, developed on deep beds of soft or only weakly indurated caliche.	0–4	Fine sandy loam [5]	SM or ML
			4+	Caliche	
Rc	Randall clay.	4 to 5 feet of poorly drained clay on the floors of enclosed depressions or intermittent lakes; on the southern high plains.	0–26	Clay	CH
			26–57+	Clay	CL
Rf	Randall fine sandy loam.	8 to 24 inches of fine sandy loam overlying poorly drained clay on floors of enclosed depressions or intermittent lakes; on the southern high plains.	0–12	Fine sandy loam [5]	SM or ML [5]
			12–24	Clay [5]	CL or CH [5]
			24–45+	Clay [5]	CL [5]
Sc	Spur clay loam.	4 to 5 feet of well-drained alluvial clay loam on the flood plains of ancient draws on the high plains.	0–22	Clay loam [5]	CL [5]
			22–34	Clay loam [5]	CL [5]
			34–66	Clay loam [5]	CL [5]
Sf	Spur fine sandy loam.	4 to 5 feet of well-drained, calcareous, alluvial fine sandy loam on flood plains of ancient draws on the high plains and rolling plains.	0–18	Fine sandy loam [5]	SM or ML [5]
			18–32	Sandy clay loam [5]	SC or CL [5]
			32–62+	Sandy clay loam [5]	SC or ML [5]
Tv	Tivoli fine sand.	6 to 7 feet of well-drained fine sand developed from wind deposits of the Quaternary period.	0–5	Fine sand [5]	SM or SP [5]
			5–72+	Fine sand [5]	SM or SP [5]
ZfA	Zita fine sandy loam, 0 to 1 percent slopes.	6 to 12 inches of fine sandy loam overlying 14 to 20 inches of well-drained sandy clay loam; developed on highly calcareous, eolian or alluvial material of the high plains.	0–12	Fine sandy loam [5]	SM or ML [5]
			12–27	Sandy clay loam [5]	SC or CL [5]
			27–36+	Sandy clay loam [5]	SC or CL [5]

[1] Based on The Unified Soil Classification System, Technical Memorandum No. 3-357, vol. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

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

[3] Data from tests by Texas State Highway Department on samples from Terry County, Texas.

physical properties of soils in Terry County, Tex.—Continued

Classification—Con.	Percent passing sieve			Permeability	Structure	Available moisture-holding capacity	pH	Shrink-swell potential
AASHO [2]	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)					
				Inches per hr.		*Inches per foot*		
A–2 or A–4 [5]	[6] 15–60	[6] 45–85	[6] 100	1. 0–2. 0	Weak, subangular blocky	1. 5	7. 5–8. 0	Low to moderate.
A–2 or A–6 [5]	[6] 20–55	[6] 45–80	[6] 100	0. 5–1. 5	Weak, prismatic and weak, subangular blocky.	0. 5–1. 5	8. 0+	Moderate.
A–6 [5]	[6] 20–55	[6] 80–100	[6] 100	0. 5–1. 5	----------	0. 5	8. 0+	Moderate.
A–4 or A–6	[4] 55–65	[4] 95–100	[4] 95–100	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	7. 5–8. 0	Moderate.
A–4 or A–6	[4] 55–65	[4] 95–100	[4] 95–100	0. 2–0. 8	Moderate, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A–6	[4] 55–75	[4] 85–100	[4] 86–99	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	0. 5	8. 0+	Low.
A–2 or A–4	[3] 20–55	[3] 95–100	[3] 100	1. 0–2. 0	Weak, subangular blocky	1. 5	7. 8–8. 0	Low to moderate.
A–2 or A–6	[3] 35–55	[3] 100	[3] 100	0. 5–1. 5	Weak, prismatic and weak, subangular blocky.	0. 5–1. 5	8. 0–8. 1	Low to moderate.
A–4 or A–6	[3] 40–55	[3] 80–95	[3] 95–100	0. 5–1. 5	----------	0. 5	8. 0+	Low to moderate.
A–4 [5]	[6] 55–80	[6] 20–45	[6] 100	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	7. 8–8. 0	Moderate.
A–6 [5]	[6] 55–80	[6] 20–45	[6] 100	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A–6 [5]	[6] 55–80	[6] 85–100	[6] 100	0. 2–0. 8	----------	0. 5	8. 0+	Moderate.
A–2 or A–4	[6] 15–55	[6] 45–85	[6] 100	1. 0–2. 0	Weak, subangular blocky	1. 5	8. 0+	Low to moderate.
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A–7	[4] 80–85	[4] 100	[4] 100	0. 0–0. 2	Moderage blocky	2. 5	7. 4–8. 0+	High.
A–7	[4] 80–85	[4] 100	[4] 100	0. 0–0. 2	Moderate blocky	2. 5	7. 4–8. 0+	High to moderate.
A–2 or A–4 [5]	[6] 15–55	[6] 45–85	[6] 100	1. 0–2. 0	Structureless	1. 5	7. 1–8. 0	Low.
A–7 [5]	[6] 55–100	[6] 0–45	[6] 100	0. 0–0. 2	Strong irregular blocky	2. 5	7. 4–8. 0+	Moderate.
A–7 [5]	[6] 55–100	[6] 0–45	[6] 100	0. 0–0. 2	Strong irregular blocky	2. 5	7. 4–8. 0+	Moderate.
A–4 [5]	[6] 55–80	[6] 20–45	[6] 100	0. 2–0. 8	Weak, subangular blocky	2. 1	7. 2–8. 0+	Moderate.
A–4 or A–6 [5]	[6] 55–80	[6] 20–45	[6] 100	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A–6 [5]	[6] 55–80	[6] 20–45	[6] 100	0. 2–0. 8	Weak, prismatic and weak, subangular blocky.	2. 1	8. 0+	Moderate.
A–2 or A–4 [5]	[6] 15–55	[6] 45–85	[6] 100	1. 0–2. 0	Weak, subangular blocky	1. 5	7. 2–8. 0+	Low to moderate.
A–2 or A–6 [5]	[6] 20–55	[6] 45–80	[6] 100	0. 5–1. 5	Weak, subangular blocky	1. 9	8. 0+	Low to moderate.
A–2 or A–6 [5]	[6] 20–55	[6] 45–80	[6] 100	0. 5–1. 5	Weak, subangular blocky	1. 9	8. 0+	Low to moderate.
A–2 or A–3 [5]	[6] 0–15	[6] 85–100	[6] 100	5. 0–20. 0	Structureless	0. 7	7. 0–7. 5	Low.
A–2 or A–3 [5]	[6] 0–15	[6] 85–100	[6] 100	5. 0–20. 0	Structureless	0. 7	7. 0–7. 5	Low.
A–2 or A–4 [5]	[6] 15–57	[6] 43–85	[6] 100	1. 0–2. 0	Weak, subangular blocky	1. 5	7. 4–7. 8	Low to moderate.
A–2 or A–6 [5]	[6] 20–55	[6] 45–80	[6] 100	0. 5–1. 5	Weak, prismatic and weak, subangular blocky.	1. 9	7. 6–8. 0	Low to moderate.
A–6 [5]	[6] 20–55	[6] 45–80	[6] 100	0. 5–1. 5	----------	0. 5	8. 0+	Low to moderate.

[4] Data from tests by Bureau of Public Roads on samples from Lynn County, Texas.

[5] Classification estimated for modal soil in survey area, using test data for soils of similar classification.

[6] Data estimated for modal soil, using USDA, Soil Conservation Service, textural chart for 2 micron clay.

[7] Gomez loamy fine sand is not mapped separately in Terry County, but it occurs in Gomez and Arch soils, a group of undifferentiated soils.

TABLE 6.—*Engineering interpretation*

Soil type and map symbol	Adaptability to winter grading	Suitability for—		Suitability as source of—	
		Road subgrade	Road fill	Topsoil	Sand and gravel
Amarillo fine sandy loam (AfA, AfB, AfC).	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Amarillo loam (AlA, AlB)	Satisfactory	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Amarillo loamy fine sand (AmB)	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Arch loam (Ar)	Satisfactory	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Arvana fine sandy loam (AvA, AvB)	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Brownfield fine sand, thick surface (Bk).	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Brownfield fine sand, thin surface (Bn).	Satisfactory	Poor	Satisfactory	Surface layer satisfactory.	Not suitable
Brownfield soils, moderately shallow (Br).	Satisfactory	Fair	Satisfactory	Surface layer satisfactory.	Not suitable
Drake soils (DrB, DrC, DrE)	Satisfactory	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Gomez loamy fine sand [1] (Ga)	Satisfactory	Fair	Satisfactory	Surface layer satisfactory.	Not suitable

See footnotes at end of table.

for soils in Terry County

Soil features affecting—					
Dikes and levees	Farm ponds		Irrigation	Terraces and diversions	Waterways
	Reservoir area	Embankment			
Moderate permeability; good to poor stability.	Moderate permeability; highly calcareous in substratum.	Good grading of soil material; moderate permeability.	Moderate permeability; moderate to high water-holding capacity.	Moderate permeability; moderate to high water-holding capacity.	Highly calcareous subsoil.
Moderate permeability; good to poor stability.	Moderate permeability; highly calcareous in substratum.	Good grading of soil material; good stability; can be made impervious by wet compaction.	Deepness of soil; high water-holding capacity.	Moderate permeability; hazard of erosion; high water-holding capacity.	Hazard of erosion; position on flat slopes.
Moderate permeability; good to poor stability; high susceptibility to wind erosion.	Moderate permeability; highly calcareous in substratum.	Poorly graded surface soil; well-graded subsoil.	Moderate permeability; high susceptibility to wind erosion; low water-holding capacity.	High susceptibility to wind erosion; poorly graded surface soil.	High susceptibility to wind erosion.
Moderate permeability; good stability.	Moderate permeability; highly calcareous in subsoil.	High in calcium; good grading of soil material; hazard of wind erosion.	Moderate permeability; low water-holding capacity.	Hazard of wind erosion; moderate permeability; low water-holding capacity.	Moderate permeability; susceptibility to wind erosion; low-water-holding capacity.
Moderate permeability; good to poor stability; underlying hard caliche.	Moderate permeability; highly calcareous in substratum.	Good grading of soil material.	Moderate permeability; moderate to high water-holding capacity.	Moderate permeability; moderate to high water-holding capacity; hard caliche substratum.	Highly calcareous subsoil; hard caliche.
Moderate permeability; good to poor stability; high susceptibility to wind erosion.	Moderate permeability; substratum high in calcium.	Poorly graded surface soil; well-graded subsoil.	Moderate permeability; high susceptibility to wind erosion; low water-holding capacity.	High susceptibility to wind erosion; well-graded subsoil.	High susceptibility to wind erosion.
Moderate permeability; good to poor stability; highly susceptible to wind erosion.	Moderate permeability; highly calcareous substratum.	Poorly graded surface soil; well-graded subsoil.	Moderate permeability; high susceptibility to wind erosion; low water-holding capacity.	High susceptibility to wind erosion; poorly graded surface soil.	High susceptibility to wind erosion.
Moderate permeability; good to poor stability; high susceptibility to wind erosion.	Moderate permeability; soft or hard caliche substratum.	Poorly graded surface soil; well-graded subsoil.	Moderate permeability; high susceptibility to wind erosion; moderate water-holding capacity.	High susceptibility to wind erosion; hard or soft caliche substratum.	High susceptibility to wind erosion; hard or soft caliche substratum.
Moderately rapid permeability; poor stability; high susceptibility to wind erosion.	Moderately rapid permeability; highly calcareous in subsoil.	Good grading of soil material.	Moderately rapid permeability; low water-holding capacity; high susceptibility to wind erosion.	Poor stability; high susceptibility to wind erosion; highly calcareous subsoil.	High susceptibility to wind erosion; highly calcareous subsoil.
Moderately rapid permeability; poor stability; high susceptibility to wind erosion.	Moderately rapid permeability; highly calcareous in subsoil.	Fair grading of soil material.	Moderately rapid permeability; high susceptibility to wind erosion; low water-holding capacity.	Poor stability; high susceptibility to wind erosion; highly calcareous subsoil.	High susceptibility to wind erosion; highly calcareous subsoil.

TABLE 6.—*Engineering interpretation for*

Soil type and map symbol	Adaptability to winter grading	Suitability for—		Suitability as source of—	
		Road subgrade	Road fill	Topsoil	Sand and gravel
Mansker fine sandy loam (MfA, MfB, MfC)	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Mansker loam (MlA, MlB)	Satisfactory	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Portales fine sandy loam (PfA, PfB)	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable
Portales loam (PlA)	Satisfactory	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Potter soils (Ps)	Satisfactory	Fair	Satisfactory	Surface layer satisfactory but thin.	Not suitable
Randall clay (Rc)	Satisfactory	Poor	Satisfactory or unsatisfactory.[2]	Poor	Not suitable
Randall fine sandy loam (Rf)	Satisfactory	Poor	Satisfactory or unsatisfactory.[2]	Poor	Not suitable
Spur clay loam (Sc)	Fair to satisfactory; may have high water table.	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Spur fine sandy loam (Sf)	Fair to satisfactory; may have high water table.	Poor to fair	Satisfactory	Surface layer satisfactory.	Not suitable
Tivoli fine sand (Tv)	Satisfactory	Fair	Satisfactory	Surface layer satisfactory.	Not suitable
Zita fine sandy loam (ZfA)	Satisfactory	Fair to poor	Satisfactory	Surface layer satisfactory.	Not suitable

[1] This soil occurs in the group of undifferentiated soils, Gomez and Arch soils.

soils in Terry County—Continued

Soil features affecting—					
Dikes and levees	Farm ponds		Irrigation	Terraces and diversions	Waterways
	Reservoir area	Embankment			
Moderately rapid permeability; fair stability; soft caliche near surface.	Moderate to rapid permeability; soft caliche subsoil near surface.	Good grading of soil material; stability; soft caliche near surface.	Shallow depth; low water-holding capacity.	Shallow depth; soft caliche near surface; low water-holding capacity.	Shallow depth; soft caliche near surface; fair stability.
Moderate permeability; good stability; caliche near surface; moderate susceptibility to wind erosion.	Moderate permeability; soft caliche subsoil near surface.	Good grading of soil material; moderate susceptibility to wind erosion.	Shallow depth; low water-holding capacity.	Shallow depth; soft caliche near surface.	Shallow depth; soft caliche near surface; moderate susceptibility to wind erosion.
Moderately rapid permeability; poor stability.	Moderately rapid permeability; highly calcareous subsoil.	Good grading of soil material.	Moderately rapid permeability; moderate water-holding capacity.	Poor stability; highly calcareous subsoil.	Highly calcareous subsoil.
Moderate permeability; good to poor stability.	Moderate permeability; calcareous substratum.	Good grading of soil material; good stability; capacity to be made impervious by wet compaction.	Moderate permeability; deep soil; high water-holding capacity.	Moderate permeability; hazard of erosion; high water-holding capacity.	Hazard of erosion; position on flat slopes; calcareous substratum.
Moderate to rapid permeability; soft or hard caliche near surface.	Moderate to rapid permeability; soft caliche subsoil near surface.	Rockiness and stoniness.	Moderate to rapid permeability; very shallow.	Very shallow; soft caliche very near the surface; stoniness.	Very shallow; caliche very near surface; stoniness.
Very slow permeability; fair stability; high shrink-swell potential; intermittent wetness	Very slow permeability; high shrink-swell potential; susceptibility to cracking.	Poor grading of soil material.	Very slow permeability; hazard of overflow.	Very slow permeability; hazard of overflow; susceptibility to cracking.	Susceptibility to cracking; hazard of overflow.
Very slow permeability; good stability; intermittent wetness; high shrink-swell potential; susceptibility to cracking.	Very slow permeability; high shrink-swell potential; susceptibility to cracking.	Poor grading of soil material; high shrink-swell potential; susceptibility to cracking; very slow permeability.	Very slow permeability; hazard of overflow; susceptibility to cracking.	Very slow permeability; hazard of overflow; susceptibility to cracking.	Susceptibility to cracking; hazard of overflow; very slow permeability.
Moderate permeability; good to poor stability.	Moderate permeability; shallow to water table.	Good grading of soil material.	Hazard of overflow; shallow to water table.	Hazard of overflow	Hazard of overflow.
Moderate permeability; good to poor stability.	Moderate permeability; calcareous substratum.	Good grading of soil material.	Moderate permeability; moderate to high water-holding capacity; shallow to water table.	Moderate permeability; shallow to water table; hazard of overflow.	Highly calcareous subsoil; hazard of overflow; shallow to water table.
Moderately rapid permeability; low stability; high susceptibility to wind erosion; hard caliche substratum.	Moderately rapid permeability; sandiness; hard caliche substratum.	Poor grading of soil material; hard caliche substratum.	Moderately rapid permeability; high susceptibility to wind erosion; low water-holding capacity.	Low stability; hazard of wind erosion.	Hazard of wind erosion; sandiness.
Moderate permeability; good to poor stability.	Moderate permeability; highly calcareous substratum.	Good grading of soil material.	Moderate permeability; moderate to high water-holding capacity.	Moderate permeability; highly calcareous substratum.	Highly calcareous substratum.

[2] Unsatisfactory when flooded.

TABLE 7.—*Engineering test data for soil samples*

Soil and location	Depth from surface	Classification			Grain-size distribution			
					Percentage passing sieve			
		USDA	Unified	AASHO	No. 200	No. 100	No. 60	No. 40
Amarillo fine sandy loam:	*Inches*							
2 miles SE. of Meadow in Terry County	0–9	Fine sandy loam	SM	A–2–4(0)	35	71	93	100
	13–20	Sandy clay loam	SC	A–6(5)	47	77	95	100
10 miles NW. of Brownfield in Terry County.	0–10	Fine sandy loam	SM–SC	A–2–4(0)	27	67	91	99
	10–54	Sandy clay loam	SC	A–6(3)	44	72	94	99
12 miles NW. of Brownfield in Terry County.	0–24	Fine sandy loam	SM	A–2–4(0)	29	72	94	100
	24–42	Fine sandy loam	SM	A–2–4(0)	33	72	93	99
3 miles W. and 0.4 mile S. of New Home in Lynn County (sec. 125, block 12).	0–6	Sandy clay loam	CL–ML	A–4(4)	42	[2]	93	99
	6–46	Fine sandy loam	SC	A–6(2)	55	[2]	96	100
	46–94	Sandy clay loam	CL	A–6(7)	67	[2]	93	96
	94–120	Sandy clay loam	CL	A–6(12)	67	[2]	94	98
12 miles W. of Tahoka and 0.8 mile S. of U.S. Highway No. 380 in Lynn County (sec. 2, block A–1).	0–11	Fine sandy loam	SM–SC	A–4(2)	43	[2]	93	100
	15–36	Sandy clay loam	CL	A–6(5)	53	[2]	94	100
	56–120	Loamy fine sand	GC	A–2–4(0)	23	[2]	37	40
3.9 miles S. and 1.8 miles E. of Lakeview in Lynn County (sec. 144, block 12).	0–11	Fine sandy loam	SM	A–2–4(0)	29	[2]	89	99
	15–56	Sandy clay loam	CL	A–6(4)	58	[2]	94	100
	96–140	Clay loam	CL	A–4(7)	71	[2]	94	97
Amarillo loamy fine sand:								
13 miles W. and 6 miles N. of Brownfield in Terry County (sec. 50, block D–11).	0–8	Loamy fine sand	SM	A–2–4(0)	18	55	88	98
	18–60	Sandy clay loam	SC	A–6(2)	39	71	93	99
1 mile SW. of Union School in Terry County (sec. 43, block T).	0–16	Loamy fine sand	SM	A–2–4(0)	19	57	88	100
	16–40	Sandy clay loam	SM–SC	A–2–4(0)	30	60	87	100
16 miles SE. of Brownfield in Terry County (sec. 20, block C–41).	0–22	Loamy fine sand	SM	A–2–4(0)	20	53	89	99
	22–48	Sandy clay loam	SC	A–6(1)	38	69	94	100
Amarillo sandy clay loam:								
7.1 miles E. and 0.6 mile S. of Wilson in Lynn County (sec. 18, block L).	0–6	Sandy clay loam	CL	A–4(6)	65	[2]	96	99
	6–38	Clay loam	CL	A–6(10)	65	[2]	60	99
	38–80	Clay loam	CL	A–6(10)	81	[2]	96	98
	80–110	Clay loam	CL	A–7–6(14)	76	[2]	95	98
2.3 miles W. of Tahoka and 0.6 mile S. of U.S. Highway No. 380 in Lynn County (sec. 564, block 1).	0–9	Sandy clay loam	CL	A–6(6)	59	[2]	92	99
	9–30	Sandy clay loam	CL	A–6(8)	63	[2]	94	99
	30–60	Clay loam	CL	A–6(9)	72	[2]	89	93
	60–80	Sandy clay loam	CL	A–6(9)	61	[2]	89	94
15 miles N. of Tahoka and 2¾ miles W. of U.S. Highway No. 87 in Lynn County (sec. 424, block 21).	0–10	Sandy clay loam	CL	A–6(9)	69	[2]	96	99
	10–40	Clay loam	CL	A–6(12)	76	[2]	98	100
	40–68	Caliche	CL	A–6(10)	78	[2]	93	95
	68–108	Sandy clay loam	CL	A–7–6(10)	56	[2]	78	83
Brownfield fine sand, thin surface:								
12 miles W. and 4½ miles N. of Tahoka in Lynn County (sec. 14, block 9).	0–13	Loamy fine sand	SM	A–2–4(0)	21	[2]	81	99
	15–84	Sandy clay loam	SC	A–6(1)	36	[2]	87	99
10.9 miles W. and 1.8 miles N. of Tahoka in Lynn County (sec. 4).	0–18	Fine sand	SM	A–2–4(0)	16	[2]	89	100
	18–64	Sandy clay loam	SC	A–6(3)	42	[2]	93	100

See footnotes at end of table.

taken in Terry County and Lynn County, Tex.[1]

Grain-size distribution—Continued												Liquid limit	Plasticity index	Maximum dry density	Optimum moisture
Percentage passing sieve—Continued							Percentage smaller than—								
No. 10	No. 4	3/8 in.	3/4 in.	1 in.	1½ in.	2 in.	0.050 mm.	0.020 mm.	0.005 mm.	0.002 mm.	0.001 mm.				
														Lb. per cu. ft.	*Percent*
							29	[2]	13	10	8	19	2	[2]	[2]
							44	[2]	33	30	28	33	17	[2]	[2]
100							24	[2]	10	9	9	20	4	[2]	[2]
100							43	[2]	25	24	23	28	14	[2]	[2]
							27	[2]	15	14	14	19	3	[2]	[2]
							31	[2]	18	16	14	20	3	[2]	[2]
100							33	20	16	13	11	29	14	116	14
							48	33	28	25	23	18	5	123	11
99	100						60	50	41	27	20	24	12	120	13
100							60	48	39	28	21	36	23	119	14
							33	18	14	12	10	18	5	123	10
							44	30	26	23	20	25	12	117	14
46	48	51	57	63	75	100	20	15	12	9	6	23	9	121	12
100							25	14	13	10	9	[3] NP	[3] NP	120	10
							45	24	21	20	18	25	11	120	12
100							67	57	49	31	18	23	10	122	12
100							17	[2]	12	11	11	19	3	[2]	[2]
100							38	[2]	28	28	27	32	16	[2]	[2]
							18	[2]	11	10	9	19	2	[2]	[2]
							28	[2]	19	18	18	24	7	[2]	[2]
100							19	[2]	11	10	10	18	2	[2]	[2]
							36	[2]	23	21	20	25	11	[2]	[2]
100							53	32	24	21	20	25	10	116	13
100							60	48	37	32	30	36	19	110	16
100							75	63	51	35	24	30	16	118	14
100							72	61	54	35	25	41	24	111	16
100							49	32	24	23	21	28	13	116	14
100							54	40	32	30	27	33	16	109	17
97	98	99	100				67	57	47	33	23	28	13	115	15
97	98	99	100				55	42	35	28	24	35	19	115	15
100							63	40	31	26	24	32	16	110	17
							67	49	38	34	32	38	19	108	18
98	99	99	100				74	61	48	29	20	30	14	114	15
91	93	97	100				52	45	37	30	25	42	24	[2]	[2]
100							14	7	6	5	3	[3] NP	[3] NP	114	11
100							31	25	24	24	22	30	15	[2]	[2]
							12	5	4	4	2	[3] NP	[3] NP	109	12
							37	27	35	24	22	30	15	118	13

TABLE 7.—*Engineering test data for soil samples taken*

Soil and location	Depth from surface	Classification			Grain-size distribution			
					Percentage passing sieve			
		USDA	Unified	AASHO	No. 200	No. 100	No. 60	No. 60
	Inches							
Brownfield fine sand, thick surface:								
12 miles SE. of Brownfield in Terry County (sec. 8, block C-39).	0-27	Fine sand	SM-SP	A-2-4(0)	11	46	85	100
	27-57	Sandy clay loam	SC	A-2-4(0)	26	54	90	100
13 miles SE. of Brownfield in Terry County (sec. 7, block C-39).	0-29	Loamy fine sand	SM	A-2-4(0)	17	56	92	100
	29-56	Sandy clay loam	SC	A-2-4(0)	32	66	95	100
14 miles W. and 10½ miles N. of Brownfield in Terry County (sec. 14, block D-14).	0-36	Fine sand	SM-SP	A-2-4(0)	9	32	85	100
	36-47	Fine sandy loam	SC	A-2-4(0)	28	45	91	100
	47-60	Fine sandy loam	SM	A-2-4(0)	19	36	87	100
13 miles W. and 4.1 miles N. of Tahoka in Lynn County (sec. 14, block 9).	1-30	Fine sand	SM	A-2-4(0)	12	[2]	89	100
	34-86	Fine sandy loam	SC	A-6(1)	39	[2]	91	100
Mansker loam:								
7 miles S. of Tahoka and 6 miles W. of U.S. Highway No. 87 in Lynn County.	0-14	Loam	CL	A-6(6)	64	[2]	89	94
	14-38	Clay loam	CL	A-6(9)	77	[2]	89	92
	38-84	Clay loam	CL	A-6(12)	71	[2]	86	89
2.8 miles W. and 3.2 miles N. of New Home in Lynn County (sec. 127, block 12).	0-16	Loam	CL	A-4(5)	59	[2]	94	98
	16-62	Loam	CL	A-6(8)	66	[2]	86	90
	62-120	Clay loam	CL	A-6(10)	66	[2]	94	98
Mansker fine sandy loam:								
7 miles S. of Tahoka and 0.6 mile W. of U.S. Highway No. 87 in Lynn County (sec. 11, block 8).	0-16	Fine sandy loam	ML-CL	A-4(4)	56	[2]	88	92
	16-30	Loam	CL	A-4(4)	56	[2]	73	76
	30-84	Sandy loam	CL	A-4(4)	53	[2]	76	81
Portales fine sandy loam:								
2 miles N. of Union School in Terry County (sec. 46, block T).	0-7	Loamy fine sand	SM	A-2-4	30	68	92	100
	36-60	Sandy clay loam	SC	A-6(3)	40	64	82	88
5½ miles NE. of Brownfield in Terry County (sec. 61, block 4X).	0-10	Loamy fine sand	SM	A-2-4	18	55	87	98
	10-40	Sandy loam	SM-SC	A-2-4	35	65	90	99
	40-60	Sandy loam	CL	A-4(1)	40	55	67	71
12 miles E. of Brownfield in Terry County (sec. 21, block C-38).	0-12	Fine sandy loam	CL	A-4(4)	53	78	94	99
	35-70+	Clay loam	CL	A-6(7)	57	73	87	91
Randall clay:								
6½ miles N. of Tahoka and 2.5 miles W. of U.S. Highway No. 87 in Lynn County (sec. 393, block 5).	0-36	Clay	CH-CL	A-7-6(18)	83	[2]	99	100
4 miles N. and 1.8 miles E. of New Home in Lynn County (sec. 28, block 20).	2-36	Clay	CH-CL	A-7-6(17)	89	[2]	99	100
2.2 miles E. and 2.8 miles S. of New Home in Lynn County (sec. 9, block 11).	4-40	Clay	CL	A-7-6(16)	79	[2]	99	100

[1] Tests on soil samples from Lynn County were made by Bureau of Public Roads (USDC). Tests on soil samples from Terry County were made by Texas State Highway Department.

in Terry County and Lynn County, Tex.[1]—Continued

Grain-size distribution—Continued												Liquid limit	Plasticity index	Maximum dry density	Optimum moisture
Percentage passing sieve—Continued							Percentage smaller than—								
No. 10	No. 4	⅜ in.	¾ in.	1 in.	1½ in.	2 in.	0.050 mm.	0.020 mm.	0.005 mm.	0.002 mm.	0.001 mm.				
														Lb. per cu. ft.	*Percent*
------	------	------	------	------	------	------	9	(2)	7	7	6	20	2	(2)	(2)
------	------	------	------	------	------	------	24	(2)	19	18	17	25	8	(2)	(2)
------	------	------	------	------	------	------	15	(2)	11	11	11	20	3	(2)	(2)
------	------	------	------	------	------	------	28	(2)	20	20	20	27	8	(2)	(2)
------	------	------	------	------	------	------	8	(2)	5	5	4	22	3	(2)	(2)
------	------	------	------	------	------	------	26	(2)	19	19	18	26	10	(2)	(2)
------	------	------	------	------	------	------	17	(2)	12	11	10	20	2	(2)	(2)
------	------	------	------	------	------	------	8	3	2	2	------	[3] NP	[3] NP	107	12
------	------	------	------	------	------	------	31	22	20	19	17	26	12	119	13
98	99	99	100	------	------	------	56	41	33	25	17	28	12	117	14
96	98	99	100	------	------	------	73	65	53	31	19	29	13	115	15
93	94	95	98	100	------	------	67	58	46	28	19	40	22	112	15
100	------	------	------	------	------	------	50	33	27	22	19	25	10	117	13
98	99	100	------	------	------	------	61	49	36	24	19	29	14	114	15
100	------	------	------	------	------	------	59	46	39	30	25	36	19	116	14
94	96	98	100	------	------	------	43	23	18	15	12	23	7	116	13
83	86	90	97	100	------	------	49	34	28	21	16	25	9	114	15
88	92	97	99	100	------	------	46	33	24	18	14	21	9	123	12
------	------	------	------	------	------	------	17	(2)	12	10	8	19	3	(2)	(2)
91	98	100	------	------	------	------	39	(2)	23	22	20	33	17	(2)	(2)
99	100	------	------	------	------	------	17	(2)	9	8	7	18	3	(2)	(2)
100	------	------	------	------	------	------	33	(2)	20	18	16	23	5	(2)	(2)
82	90	95	100	------	------	------	39	(2)	28	20	14	27	10	(2)	(2)
100	------	------	------	------	------	------	47	(2)	19	15	11	25	9	(2)	(2)
93	95	97	(2)	97	100	------	54	(2)	41	32	24	30	17	(2)	(2)
------	------	------	------	------	------	------	75	57	48	43	38	51	33	100	22
------	------	------	------	------	------	------	83	66	55	47	44	49	29	102	20
------	------	------	------	------	------	------	72	56	47	42	38	45	26	101	22

[2] Not determined.
[3] NP=Nonplastic.

Within each group, the relative engineering value of the soil material is indicated by a group index number. These numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol (see table 5).

The classification by grain size in table 5 was determined from data compiled by the Bureau of Public Roads and by the Texas State Highway Department. If test data giving grain size were not available, the range of grain sizes was determined for a typical soil from the USDA textural classification chart for 2-micron clay.

The values for permeability and for available water were compiled from the data in the work unit technical guide used by technicians in the county. Permeability is the rate, given in inches per hour in table 5, that water moves through a soil horizon. The available water is listed in inches per foot of depth. This is a measure of the water-holding capacity of a soil. A layer of Amarillo fine sandy loam, 1 foot thick, will hold 1.5 inches of water placed on the surface. If another 1.5 inches of water is added, another foot of soil will be wetted. A layer of Tivoli fine sand, 1 foot thick, will hold only 0.7 inch of water.

The shrink-swell potential was estimated by technicians familiar with the soils of the area. There are no dispersed soils in the survey area.

The shrink-swell potential is an estimate of how much a soil shrinks and swells under extremes of dryness and wetness. A knowledge of this potential is important in planning the use of a soil for building roads and other engineering structures.

The depth to the seasonably high water table is not given in table 5 because all soils in the county except the Spur soils have a very low water table. At times, the Spur soils have a high water table.

Engineering Interpretation of Soils

In table 6 are the results of evaluating the soils of the county from an engineering standpoint. This interpretation is based on the information in table 5, actual test data that were available, and the knowledge of specialists. Also available was information from State highway engineers and personnel in construction companies.

Practically all soils in the county are suitable for fill material if the material is properly placed and compacted. To make the best fill material, the sandy surface layer of some soils must be graded with the finer textured layers in the soil profile. The most difficult soils to place and compact are the sands that do not contain enough fine material for binding. The heavier soils are more easily compacted, but they may be overcompacted. Overcompaction may cause an unstable fill and a corrugated and uneven surface.

In engineering construction in Terry County, the bedrock under the soils is not likely to be reached.

Irrigation water can be applied to the soils in the county by sprinkler or by flooding. The level-border system and the level- or graded-furrow system are suited to the fine- and medium-textured soils. Sprinklers can be used for irrigating all soils in the county, but they are best suited to the coarse-textured, sandy soils and the soils in rough areas.

Terraces and diversions can be constructed on most soils in the county, but, on the coarser textured soils, they are difficult to maintain. It is difficult to keep the terrace ridges and channels in good condition. Soil material accumulates in channels, and some is blown out of the ridges by the wind.

Wind erosion is also a great hazard to waterways constructed in the area. Windblown materials accumulate in waterways and smother the vegetation. They also hinder the flow of water.

Generally, the soils in Terry County are not suitable for ponds. The top layers of many soils in the county may be suitable for the construction of pond fills, but the underlying layers will not hold water in the reservoir areas.

The surface layer of almost all soils in the county can be used as topsoil material. Some soils, however, have a thin surface layer and do not supply much topsoil material. Although a little sand and gravel can be quarried in small overwash areas, no area is large enough for the sand and gravel to be obtained on a commercial basis.

The hard caliche underlying many of the soils in the survey area can be used for subgrade and subbase material. It is also suitable for use in asphalt surfacing if the caliche is properly crushed and graded.

All the soils in the county can be graded in winter. Even the Spur soils, which are likely to be wet, are not likely to be hard to grade. Long periods of subfreezing weather probably will not occur.

Engineering Test Data

In table 7 are the results from tests of soil samples from soils in Terry County and Lynn County, Texas. Soil samples from Lynn County are the same kinds of soils as those tested in Terry County. The tests were made according to standard procedure so that the soils could be evaluated for engineering purposes.

The result of a mechanical analysis, obtained by the combined sieve and hydrometer method, can be used to determine the relative proportions of different size 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 the soil textural classes used by the Soil Conservation Service.

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 very dry state, the material changes from a solid to a semisolid, or 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 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.

In a moisture-density test, or compaction test, a sample of soil material is compacted several times with the same compactive effort, each time at a higher moisture content. The dry density (unit weight) of the soil material increases until the "optimum moisture content" is reached. After that, the dry density decreases with an increase in moisture content. The highest dry density obtained in the compaction tests is termed "maximum dry density." Moisture density data are important in earthwork because, as a rule, optimum stability is obtained if the soil is compacted to about maximum dry density when it is at approximately the optimum moisture content.

Formation, Classification, and Morphology of Soils

This section has three main parts. The first part tells how the soils of Terry County were formed. In the second part the soil series in the county are listed in their respective soil orders and great soil groups. The third part consists of a table that describes the soil horizons of important soils as well as the underlying material and the relief of these soils.

Factors of Soil Formation

Soil is produced when climate, living organisms, parent materials, and relief interact during a period of time. These interactions are reflected by the characteristics of the soils that develop on the surface of the earth.

Climate and living organisms, especially vegetation, are active forces in soil formation. These forces act slowly on the parent materials, and a natural body, or soil, that has genetically related horizons is formed. The relief modifies the effects of climate and vegetation, and the parent materials have much to do in determining the kind of soil that develops. Time is needed for changing the parent materials into a soil profile. Generally, it takes a long time for distinct, genetically related horizons to form.

Because the interrelationships among the factors of soil formation are complex, it is difficult to specify the effects of any one factor. Therefore, when studying the effects of a single factor, it should be remembered that the soil profile is a result of the interaction of all factors.

Climate

The subhumid, warm-temperate continental climate of Terry County has a definite effect on the formation of soils. Because rainfall is limited and the soils are seldom wet below the zone of living roots, calcium carbonate has accumulated in a horizon in most zonal and intrazonal soils. Many of the young soils in the county have free lime throughout the profile because not enough rainwater has passed through the young soils to leach the lime.

The dashed lines showing the calcium carbonate ($CaCO_3$) equivalent in figure 17 illustrate that there is free lime throughout the profile in the relatively young Portales fine sandy loam. The Amarillo fine sandy loam has no free lime above a depth of about 40 inches. Note the bulge in the line showing the $CaCO_3$ equivalent in both soils. This bulge represents the calcium carbonate equivalent in the C_{ca} horizon. The bulge is thought to occur at the normal depth of moisture penetration.

Water moving through the profile had another effect on soil formation in the zonal soils. The water moved slowly downward and carried clay particles from the surface horizon to the subsoil. These clay particles were deposited when the movement of the water became slower. As the clay content of the subsoil increased, the movement of water was further slowed and clay was deposited at an even greater rate.

The solid line representing the percentage of clay in figure 16 bulges in the B horizon of the Amarillo fine sandy loam but is a smooth curve throughout the profile of the Portales fine sandy loam. This difference in curve represents a difference in clay accumulation in the two soils and is another indication of the relative age of the soils.

Strong, variable wind has also affected the development of soils in Terry County. In the Illinoian age of the Pleistocene era, sands were deposited by wind over alluvial materials. Today coarse sands are shifted about on the surface (*5*).

Living organisms

The native vegetation that covered the county affected the formation of soils more than any other living organisms. This vegetation was of the mixed prairie type and ranged from mid and short grasses on the clay loams to post-climax tall grasses and shin oak on the sandy soils. Decaying leaves left large amounts of organic matter on the surface of the soil, and decaying roots added organic matter to the solum. When the roots decayed, a network of tubes and pores was left in the soil. These tubes and pores permitted air and water to move through the soil more readily. The organic matter added to the soil provided abundant food for soil bacteria, actiniomycetes, and fungi.

The activity of earthworms and some of the results of this activity are easy to observe. Worm casts make up as much as 40 percent of some of the B_2 horizons of Amarillo soils. This indicates that there has been much worm working in these horizons. Worm working helps to form granular structure. The tubes and pores caused by worm activity allow air and water to move more freely through the soil. They also permit roots to grow more easily. By mixing the soil horizons, insects and rodents have also affected soil development.

Within the past 50 years, man has strikingly affected the development of soils. He has fenced the range, allowed it to be overgrazed, and changed the vegetation. He has plowed the soil and planted crops. After he harvested the crops and left the soil bare, wind and water erosion increased. The amount of organic matter, silt, and clay in the plow layer was reduced. Heavy machinery and ill-timed tillage compacted the soil and thereby reduced the movement of air and water in the soil. In effect, man has even changed the climate in some areas by irrigating the soil. All of this activity of man has greatly affected the development of soils.

Parent materials

The block diagrams in figures 18 and 19 show the kinds of parent materials that underlie the soils of Terry County.

All the soils in the county have developed from Quaternary or late Tertiary materials that are commonly called Rocky Mountain outwash. These parent materials are mostly alkaline to calcareous, unconsolidated, sandy and silty earths. Since they were first deposited, these materials may have been reworked by the wind or affected by a high water table. Some areas, which appear to

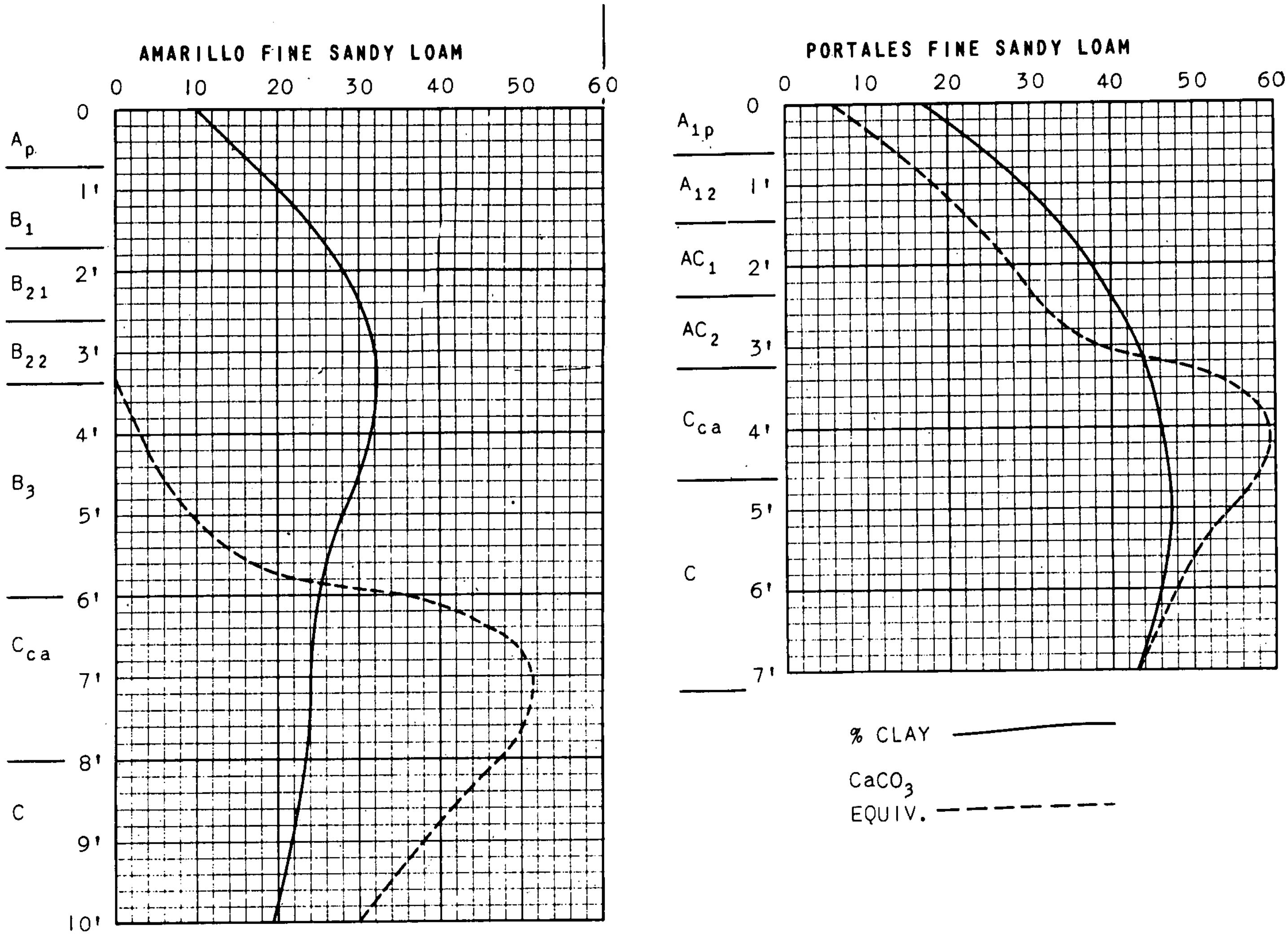

Figure 17.—**Comparative clay content and calcium carbonate ($CaCO_3$) equivalent in Amarillo fine sandy loam and Portales fine sandy loam.**

have been shallow enclosed basins, have had lime added from the surrounding slopes.

Eight profiles in adjacent Lynn County were studied. These soils have similar gross mineralogy, even though their texture ranges from fine sand to clay. The chemical and mineralogical properties for the clay fractions are strikingly similar for all eight profiles.[5]

Relief

Terry County is a nearly level to very gently undulating constructional plain that has little dissection. The northwestern part of the county is the most undulating, largely because eolian deposits of sand have been shifted and reworked by wind.

The elevation ranges from 3,200 feet above sea level in the southeastern part of the county to 3,600 feet in the northwestern part. Brownfield, which is near the center of the county, has an elevation of 3,312 feet. There is a general slope of about 10 feet per mile from the northwest to the southeast.

[5] KUNZE, GEORGE W. MINERALOGICAL, CHEMICAL, AND PHYSICAL PROPERTIES OF TEXAS SOILS AND THEIR RELATIONSHIP TO SOIL FORMATION AND PLANT GROWTH. State Project 928. 1957.

Two relict drainageways, Sulphur Springs Draw and Lost Draw, cross the county from northwest to southeast. These draws are shallow and are usually dry; they seldom carry runoff water.

Rich Lake and Mound Lake are the largest salt lakes in the county. Around these lakes is the sharpest relief. The eolian hills that border the east sides of these lakes are 100 feet or more higher than the lake beds.

Playas, or shallow lakes, are common in areas where fine sandy loams and sandy clay loams prevail, but playas do not occur in the sandier areas. The playas range from 2 to 40 acres in size. They provide the only surface drainage in many areas.

Time

The length of time that climate, living organisms, and relief have had to change the parent material affects the kind of soil that develops. Young soils have had little development. Their soil material has not been in place long enough for the formation of well-defined horizons that are genetically related. Examples of young soils are soils on bottom lands and soils on eolian dunes that border the playas.

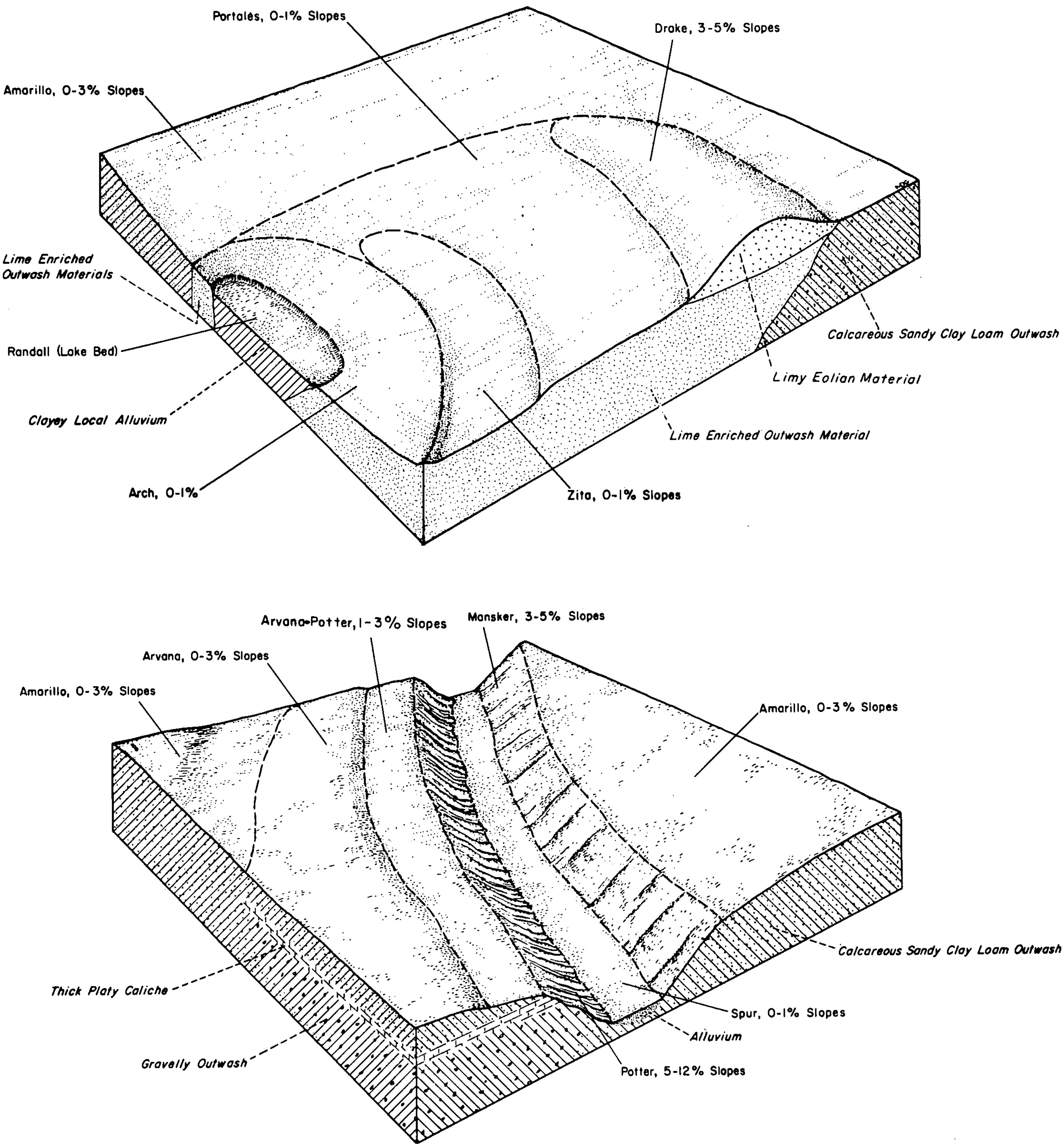

***Figure 18.—Top,* soils in a playa and associated soils; *bottom,* soils in an ancient drain and associated soils.**

Soils are considered mature, or old, if they have been in place for a long time and have approached equilibrium with their environment. These old soils show marked horizon differentiation. They generally are well drained and nearly level to gently sloping.

Classification

Soils are classified in orders, great soil groups, and series. The soil orders are zonal, intrazonal, and azonal.

The zonal order consists of soils that have distinct,

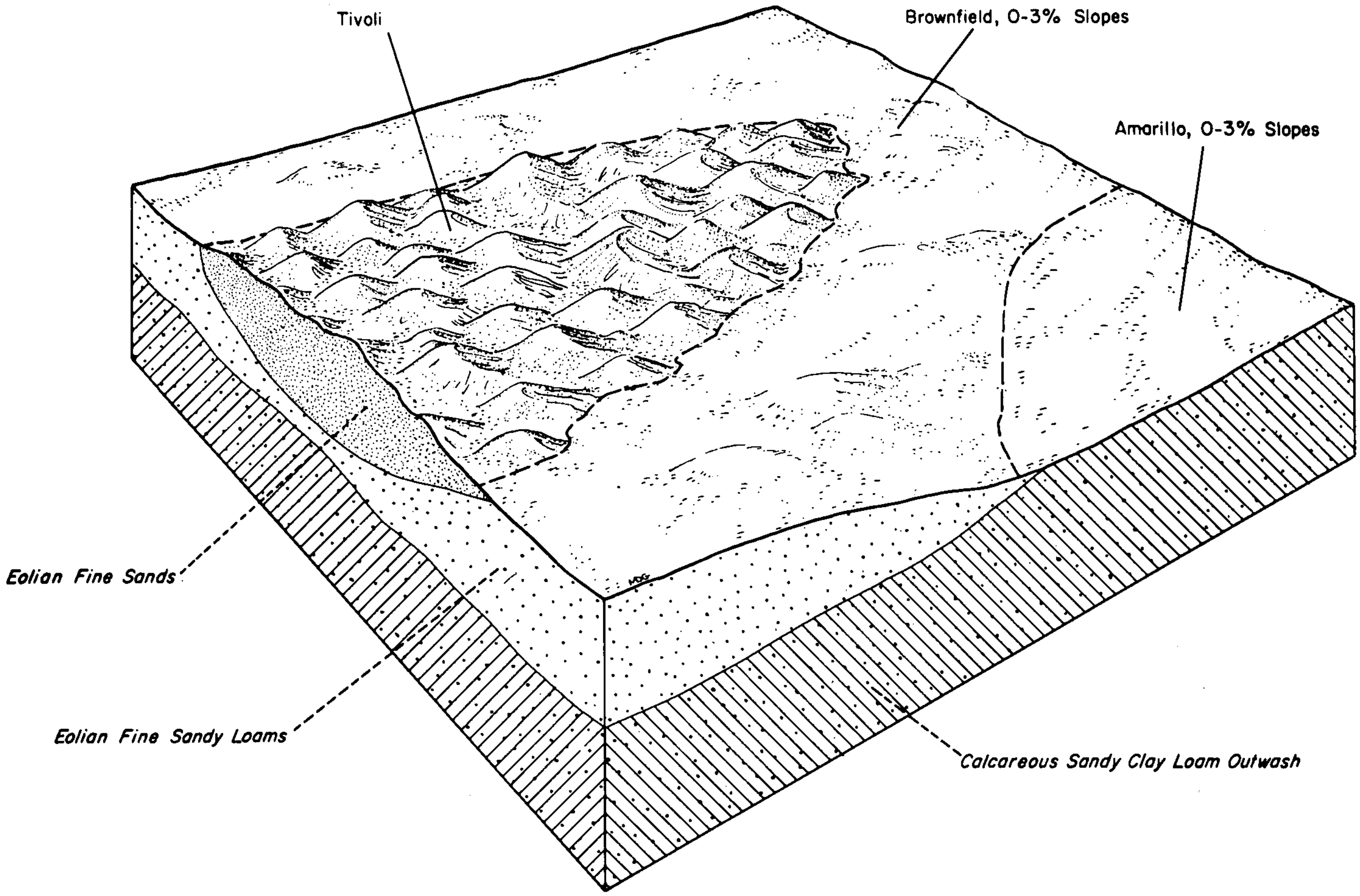

Figure 19.—Soils developed from sandy parent material.

genetically related horizons and other soil characteristics that reflect the predominant influence of climate and living organisms. These soils have an A, B, C sequence of horizons.

The intrazonal order consists of soils commonly having less well developed horizons than those in zonal soils. The characteristics of intrazonal soils reflect the dominating influence of relief, parent material, or age over the influence of climate and living organisms.

The azonal order consists of soils that have had little or no development of the soil profile. The profile of these soils lacks development because of youth, resistant parent material, or steep topography. Normally only a weak A_1 horizon has developed in azonal soils.

A great soil group is a group of soils that have major features in common. Each great soil group is made up of many soil series. The great soil groups in Terry County are the Reddish Chestnut, Reddish Brown, Chestnut, Calcisol, Grumusol, Lithosol, Regosol, and Alluvial.

A classification of all the soil series in Terry County, according to their soil orders and great soil groups, is shown in the following list:

Zonal soils—
- Reddish Chestnut soils:
  - Amarillo
  - Arvana
- Reddish Brown soil:
  - Brownfield
- Chestnut soil:
  - Zita

Intrazonal soils—
- Calcisols:
  - Arch
  - Gomez
  - Mansker
  - Portales
- Grumusol:
  - Randall

Azonal soils—
- Lithosol:
  - Potter
- Regosols:
  - Drake
  - Tivoli
- Alluvial soil:
  - Spur

ZONAL SOILS: The Amarillo, Arvana, Brownfield, and Zita soils are thought to be nearly in equilibrium with their environment. The Amarillo soils are somewhat similar to the Arvana soils. The Amarillo soils, however, developed in a thick bed of parent materials, whereas the

Arvana soils developed in a thin layer. The Arvana soils are less than 36 inches thick and overlie relict hard caliche. The Brownfield soils developed from parent materials that were more sandy and less calcareous than those of the Arvana soils. The Zita soils have developed from very strongly calcareous materials. They normally occupy slightly depressional areas.

INTRAZONAL SOILS: The Arch, Mansker, Portales, and Gomez soils have all developed from parent materials that have been enriched with lime. They are Calcisols. The length of time that these soils have been developing and the relief has much to do in determining the kinds of soils that develop. Mansker soils normally develop on a gently sloping ridge where not so much water percolates through the profile as does in the adjacent more nearly level Portales soils. The Gomez soils have developed in more sandy parent materials than those of the Arch, Mansker, and Potter soils. The Randall soils developed from very clayey materials and are Grumusols.

AZONAL SOILS: The very shallow Potter soils have developed from soft caliche on steep slopes or from harder, more resistant caliche on gentle slopes. Drake soils are young and have formed in materials that were fairly recently blown from nearby playas and deposited. Tivoli soils have developed from siliceous materials that contain only a small amount of minerals that can be weathered. The Spur soils are on recent alluvium and, except in the A_1 horizon, show little horizon differentiation.

Morphology

Table 8 is presented so that the genetic and morphologic relationships of the horizons in the soils of important soil types can be compared. The Spur soils and Gomez soils are not included in table 8. Profiles representing the soil types shown in this table and all other soil types in the county are described in the subsection "Descriptions of Soils".

General Nature of the Area

This section was prepared mainly for those not familiar with the area. It contains subsections on climate, natural resources, history, and other subjects of general interest.

Climate

Terry County has the warm-temperate, subhumid continental climate that is characteristic of the southern part of the high plains. The average annual temperature is about 62° F., but temperatures vary widely. The average annual precipitation is 18.61 inches. The median rainfall, or the amount of rainfall that occurs most often, is 15.95 inches per year. Much of the rainfall comes in local showers that occur in spring and in summer. Figure 20 shows the annual rainfall for the 48-year period extending from 1910 through 1957.

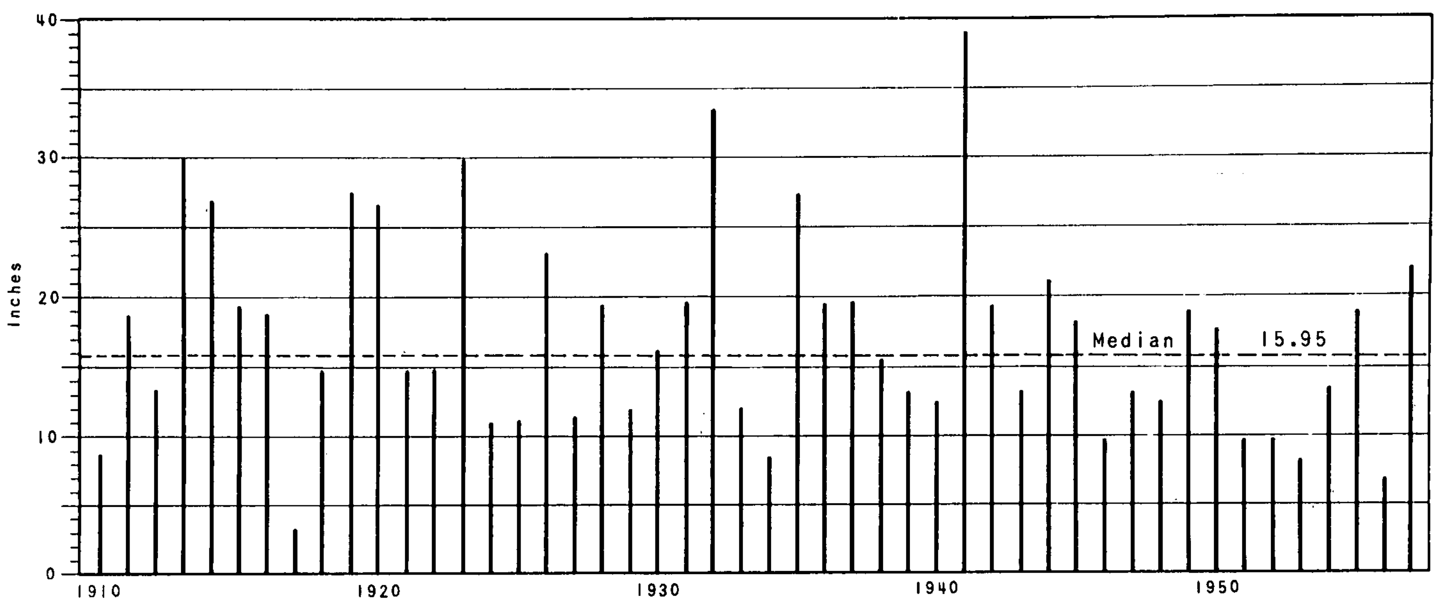

***Figure 20.*—Annual rainfall, 1910 through 1957, in Terry County.**

TABLE 8.—*Morphology and relief of important soils in Terry County, Tex.*

Soil type	Great soil group	Surface layer (A horizon)	Subsoil	Underlying materials	Relief
Amarillo loam	Reddish Chestnut.	Brown to reddish-brown loam; weak, prismatic and weak, subangular blocky; friable; few worm cavities; noncalcareous; about 10 inches thick; clear boundary.	B_2 horizon—Reddish-brown to brown sandy clay loam to clay loam; weak, prismatic to moderate, medium, prismatic; firm; noncalcareous; about 20 inches thick; gradual boundary. B_3 horizon—Reddish-yellow to brown sandy clay loam; weak, subangular blocky; threads and films of calcium carbonate; few concretions and fragments of calcium carbonate; strongly calcareous; gradual boundary.	C_{ca} horizon—At depths of 30 to 48 inches; reddish-yellow to pink sandy clay loam; 50 percent of material is concretions of calcium carbonate; very strongly calcareous; underlain by caliche in some places.	Smooth, nearly level to gently sloping; slopes less than 3 percent.
Amarillo fine sandy loam.	Reddish Chestnut.	Reddish-brown to brown fine sandy loam; structureless; very friable; noncalcareous; about 11 inches thick; abrupt boundary.	B_{21} horizon—Reddish-brown to dark-brown sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; friable; much biological activity; noncalcareous; about 12 inches thick; clear to gradual boundary. B_{22} horizon—Yellowish-red to dark yellowish-brown sandy clay loam; coarse, prismatic and weak, subangular blocky; about 8 inches thick; abrupt to clear boundary. B_3 horizon—Red to light-brown sandy clay loam; threads and films as well as fragments and concretions of calcium carbonate; noncalcareous to strongly calcareous; about 10 inches thick; abrupt to clear boundary.	C_{ca} horizon—At depths of 36 to 72 inches; yellowish-red to pink sandy clay loam; violent reaction to hydrochloric acid; concretions of calcium carbonate make up 50 percent of horizon.	Smooth, nearly level to gently sloping; slopes normally less than 3 percent.
Amarillo loamy fine sand.	Reddish Chestnut.	Yellowish-red to brown loamy fine sand; structureless; very friable; noncalcareous; about 14 inches thick; grades through layer of fine sandy loam 3 to 6 inches thick; abrupt boundary.	B_{21} horizon—Red to brown sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; much biological activity but less than in the Amarillo fine sandy loams; noncalcareous; gradual to clear boundary.	C_{ca} horizon—At depths of 40 to 72 inches; reddish yellow to pink; strongly calcareous to very strongly calcareous; fewer concretions and fragments of calcium carbonate than in Amarillo fine sandy loams.	Smooth to very slightly undulating; slopes normally less than 3 percent.

			B_{22} horizon— Yellowish-red to pale-brown sandy clay loam; moderate coarse, prismatic and weak, subangular blocky; noncalcareous; 7 to 27 inches thick; abrupt to clear boundary. B_3 horizon— Yellowish-red to reddish-brown sandy clay loam; about 6 inches thick; may or may not be calcareous; abrupt boundary.		
Arch loam	Calcisol	Light brownish-gray to brown clay loam; very strongly calcareous; about 8 inches thick; abrupt boundary.	Light-gray to light grayish-brown clay loam; moderate, coarse, prismatic and weak, subangular blocky; few soft concretions of calcium carbonate; very strongly calcareous; 18 to 20 inches thick; clear boundary.	C_{ca} horizon— Light-gray to pinkish-white earth at a depth of about 20 inches; violent reaction to hydrochloric acid.	Slightly depressional areas; small benches above playas or broad flats.
Arvana fine sandy loam.	Reddish Chestnut.	Reddish-brown to dark-brown fine sandy loam; very weak, subangular blocky; very friable; 8 to 12 inches thick; abrupt boundary.	B_{21} horizon— Reddish-brown to dark-brown sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; moderate biological activity; noncalcareous; 10 to 12 inches thick; abrupt boundary. B_{22} horizon— Yellowish-red to reddish-brown sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; about 14 inches thick; noncalcareous abrupt boundary.	D horizon— Thick, platy caliche at depths of 20 to 40-inches.	Smooth, nearly level to gently sloping; generally occurs in transitional areas or on slight ridges between areas of shallow Amarillo and Arvana soils.
Brownfield fine sand, thin surface.	Reddish Brown.	Yellowish-red to brown fine sand; structureless; very friable; little biological activity; noncalcareous; about 12 to 16 inches thick; clear to abrupt boundary.	B_{21} horizon— Red to reddish-brown sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; none to very little biological activity; 10 to 28 inches thick; noncalcareous; clear to gradual boundary. B_{22} horizon— Red to yellowish-red sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky; about 10 to 20 inches thick; noncalcareous; boundary abrupt to D and clear to C horizon, if C horizon is present.	C horizon (where present)— Yellowish-red, noncalcareous fine sandy loam.	Undulating; nearly level to gently rolling, long slopes of 0 to 3 percent; small areas with slopes of 3 to 5 percent; normally occurs at higher elevations than adjoining Amarillo soils.

TABLE 8.—*Morphology and relief of important soils in Terry County, Tex.*—Continued

Soil type	Great soil group	Surface layer (A horizon)	Subsoil	Underlying materials	Relief
Brownfield fine sand, thick surface.	Reddish Brown.	Yellowish-red to brown fine sand; structureless; very friable; little biological activity; noncalcareous; about 20 to 40 inches thick; clear to abrupt boundary.	B horizon— Similar to B horizon in Brownfield fine sand, thin surface, but somewhat thinner and coarser in texture.	C horizon (where present)— Yellowish-red, noncalcareous fine sandy loam.	Similar to relief of Brownfield fine sand, thin surface but the microrelief is extremely undulating and some areas have dunelike topography.
Drake soils	Regosol	Grayish-brown to brown clay loam; structureless; about 8 inches thick; strongly calcareous; abrupt boundary.	AC_1 horizon— Light-gray to light brownish gray clay loam; weak, coarse, prismatic and fine, subangular blocky; from 16 to 25 inches thick; very strongly calcareous; clear to diffuse boundary.	C horizon— White to pink heavy fine sandy loam to sandy clay loam; very strongly calcareous.	Sloping to steep stabilized dunes on the eastern, or lee, side of playas.
Mansker loam	Calcisol	Dark grayish-brown to brown light clay loam to loam; weak, coarse, prismatic and weak; subangular blocky; about 5 inches thick; strongly calcareous: gradual boundary.	AC horizon— Pale-brown to grayish-brown clay loam; from 3 to 14 inches thick; very strongly calcareous.	C_{ca} horizon— Very pale brown to white clay loam; very strongly calcalcareous; abrupt boundary. D horizon— Rocklike caliche.	Nearly level to sloping along draws; surrounded by larger areas of Portales and Amarillo soils.
Mansker fine sandy loam.	Calcisol	Dark-brown to grayish-brown fine sandy loam; weak, coarse, prismatic and weak, subangular blocky; weakly calcareous to very strongly calcareous; about 8 to 12 inches thick; clear boundary.	Reddish-brown to light grayish-brown sandy clay loam; weak, coarse, prismatic and weak, subangular blocky; strongly calcareous to very strongly calcareous; about 5 to 13 inches thick; gradual to abrupt boundary.	C_{ca} horizon— Reddish-brown to sandy clay loam; white chalky earth; very strongly calcareous; diffuse to abrupt boundary. C horizon— Yellowish-red to white clay loam; very strongly calcareous. D horizon (when present) Hard rocklike caliche.	Nearly level areas adjacent to Potter soils and within large areas of Portales fine sandy loam.
Portales loam	Calcisol	Grayish-brown to dark grayish-brown loam; weakly calcareous to strongly calcareous; about 12 to 18 inches thick.	Light-gray to light brownish-gray clay loam; weak, prismatic and weak, subangular blocky; strongly calcareous to very strongly calcareous; about 10 inches thick; clear boundary.	C_{ca} horizon— Pink to white clay loam; strongly calcareous to very strongly calcareous; many concretions of calcium carbonate.	Nearly level depressional areas that appear to be floors or benches of ancient lakes.
Portales fine sandy loam.	Calcisol	Dark grayish-brown to dark yellowish-brown fine sandy loam; structureless; weakly calcareous to strongly calcareous; 6 to 14 inches thick; abrupt boundary.	Grayish-brown to brown sandy clay loam; weak, coarse, prismatic and weak, subangular blocky; few hard and soft fragments and concretions of calcium carbonate; strongly calcareous to very strongly calcareous; 8 to 19 inches thick; clear to gradual boundary.	C_{ca} horizon— Very pale brown to pink sandy clay loam; as much as 50 percent, by volume, consists of soft and hard concretions and fragments of calcium carbonate; very strongly calcareous; gradual boundary. C horizon— Very pale brown to pink sandy clay loam; strongly calcareous.	Nearly level depressional areas that appear to be floors or benches of ancient lakes.

Potter soils	Lithosol	Brown fine sandy loam to clay loam; structureless; strongly calcareous; 4 to 10 inches thick; abrupt boundary.	Not present	Semi-indurated to soft, white caliche.	Steep slopes of ancient drains
Randall clay	Grumusol	Dark-gray to light brownish-gray clay; neutral to strongly calcareous; 8 to 26 inches thick; abrupt boundary.	Dark-gray to grayish-brown clay; pale-brown mottles may occur; lighter in color with depth; noncalcareous.	C horizon— Grayish-brown heavy clay loam; few medium, distinct mottles; occurs at depth of about 3 feet and may extend to 6 feet or more; few soft concretions of calcium carbonate in lower 6 inches.	Level playa floors that are under water for extended periods.
Randall fine sandy loam.	Grumusol	Brown fine sandy loam; structureless; loose; noncalcareous; about 8 to 24 inches thick; abrupt boundary.	Dark-gray to grayish-brown clay; pale-yellow mottles may occur; lighter in color with depth; neutral to strongly calcareous.	Not determined	Level floors of playas; remains under water for extended periods.
Tivoli fine sand	Regosol	Light yellowish-brown to brown fine sand; loose; faint organic stains; noncalcareous; 5 to 10 inches thick; gradual boundary.	C horizon— Pink to reddish-yellow fine sand; structureless; noncalcareous; 5 to 66 inches or more thick.	Not determined	Very undulating to rolling with large areas of dune-like topography; normally at a higher elevation than adjoining soils.
Zita fine sandy loam.	Chestnut	Brown to dark grayish-brown fine sandy loam; structureless; noncalcareous; 5 to 17 inches thick.	AC_1 horizon— Very dark grayish-brown to brown sandy clay loam; weak subangular blocky; noncalcareous; 5 to 11 inches thick; clear to gradual boundary. AC_2 horizon— Dark grayish-brown to very pale brown sandy clay loam; structure as in AC_1; noncalcareous to strongly calcareous; 8 to 13 inches thick; gradual to clear boundary.	C_{ca} horizon— White to pale-brown sandy clay loam to clay loam; very strongly calcareous; soft concretions of calcium carbonate.	Nearly level to depressional areas that appear to be the floors or benches of ancient playas.

Table 9 lists average monthly, seasonal, and annual temperatures and precipitation, as compiled from the records of the United States Weather Bureau station at Lamesa, Dawson County, Texas.

TABLE 9.—*Temperature and precipitation at Lamesa, Dawson County, Texas*

[Elevation, 2,975 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1917)	Wettest year (1941)	Average snowfall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	43. 2	84	3	0. 91	0. 00	0. 00	0. 9
January	42. 0	83	0	. 52	. 21	. 56	1. 2
February	46. 1	87	−12	. 78	. 31	. 94	. 8
Winter	43. 8	87	−12	2. 21	. 52	1. 50	2. 9
March	53. 5	95	7	. 77	. 10	3. 20	. 8
April	62. 1	98	23	1. 49	. 52	3. 96	. 1
May	70. 4	103	37	2. 06	. 36	9. 27	(3)
Spring	62. 0	103	7	4. 32	. 98	16. 43	. 9
June	78. 6	108	46	2. 35	. 00	1. 08	(3)
July	80. 7	111	54	2. 08	. 23	1. 93	(3)
August	80. 2	110	52	2. 16	. 19	2. 62	(3)
Summer	79. 8	111	46	6. 59	. 42	5. 63	(3)
September	73. 4	105	37	2. 42	1. 11	2. 88	. 0
October	63. 7	101	28	2. 28	. 00	12. 50	(3)
November	51. 4	91	10	. 79	. 19	. 13	. 1
Fall	62. 8	105	10	5. 49	1. 30	15. 51	. 1
Year	62. 1	111	−12	18. 61	3. 22	39. 07	3. 9

[1] Average temperature based on a 28-year record, through 1955; highest temperature on a 22-year record and lowest temperatures on a 21-year record, through 1952.

[2] Average precipitation based on a 45-year record, through 1955; wettest and driest years based on a 45-year record, in the period 1910–1955; snowfall based on a 41-year record, through 1952.

[3] Trace.

The least precipitation is in winter, and the most is in summer. Spring has sudden wide variations in temperature that last only a short time. The temperature in April may be in the 90's one day and in the 20's the next. Also, in spring there are high winds and accompanying sandstorms.

Nearly 4 inches of rain falls during July and August in local thundershowers. Much of this rain is ineffective because the humidity is low and temperatures and rates of evaporation are high. The velocity of wind is high in summer.

Temperature and precipitation decrease gradually in September, October, and November. Both September and October have 2 inches or more of rainfall, but November has less than 1 inch. In October cover crops may be fairly well established. However, the low rainfall from November to March makes it difficult to grow enough cover to protect the soil from wind or water erosion.

Earl Burnett and W. C. Moldenhauer studied the characteristics of rainfall on the plains of Texas and estimated the effect of this rainfall on the probable yields of cotton (*2*).

April 8 is the average date of the last freezing temperature in spring, and November 2 is the average date of the first freezing temperature in fall. A freezing temperature has 1 chance in 20 of occurring after May 1 or before October 22, and 1 chance in 5 of occurring after April 20 or before October 24. Days without a temperature as low as 32° average 205 per year, and days without a temperature of 20° average 230 (*1*).

Hail is a hazard in Terry County. May and June have more days with hail than other months, and April has the next largest number of days with hail.

Early History, Development, and Population

The area that is now Terry County was a favorite hunting ground for the Comanche Indians until the 1870's, when buffalo hunters opened the area to ranch settlement. Terry County was created from Bexar Territory in 1876 and named for Benjamin Franklin Terry.

In 1900, the people in the county lived on thinly scattered ranches. After 1902, school land was made available and much of the land granted to railroads was put on sale. Settlers acquired these lands and established farms.

In 1904, the county was organized and Brownfield was selected the county seat. The Santa Fe Railroad completed its line through the county in 1917.

A trend from ranching to row-crop farming has been steady. Nearly all of the rangeland that is suited to cultivated crops is now cultivated.

Natural Resources

Soil is the most important natural resource in Terry County. The nourishing grass that grew on the soil attracted the first settlers, who established ranches. The fertile soil that developed under grass attracted farmers, and agriculture expanded and surpassed ranching.

Oil has greatly influenced the economy of Terry County. More than 600 wells produce more than 40,000 barrels of oil daily. Some sodium sulfate is mined from the saline lakes.

Underground water is another valuable resource because enough of it is available to irrigate much of the county.

The only game birds in the county are blue quail, bobwhite quail, and very few prairie chickens. Migratory ducks are plentiful in fall if there is water in the playas. There are a few antelope in the larger areas of rangeland. Diamond back rattlesnakes are plentiful.

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GUIDE FOR MAPPING UNITS

[See table 3, p. 26, for estimated yields; table 2, p. 5, for approximate acreage of each soil; and pages beginning at p. 33 for a discussion of the engineering applications of soils]

Map symbol	*Mapping unit*	*Page*	*Dryland capability unit*	*Page*	*Irrigated capability unit*	*Page*	*Range site*	*Page*
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes	5	IIIe-2	22	IIe-2	22	Mixed Land	31
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes	6	IIIe-3	22	IIIe-3	22	Mixed Land	31
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes	6	IVe-1	22	IVe-1	22	Mixed Land	31
AlA	Amarillo loam, 0 to 1 percent slopes	7	IIIce-1	21	IIe-1	21	Deep Hardland	32
AlB	Amarillo loam, 1 to 2 percent slopes	8	IIIe-1	21	IIIe-1	21	Deep Hardland	32
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes	6	IVe-3	23	IIIe-5	23	Sandy Land	31
Ar	Arch loam	8	IVe-2	23	IIIe-4	23	High Lime	31
AvA	Arvana fine sandy loam, 0 to 1 percent slopes	9	IIIe-2	22	IIe-2	22	Mixed Land	31
AvB	Arvana fine sandy loam, 1 to 3 percent slopes	9	IIIe-3	22	IIIe-3	22	Mixed Land	31
AwB	Arvana fine sandy loam, shallow, 0 to 3 percent slopes.	9	IVe-4	23	IIIe-6	23	Mixed Land	31
Ax	Arvana-Potter complex	9	VIe-3	24	--------		Shallow Land	32
Bk	Brownfield fine sand, thick surface	10	VIe-2	24	IVe-7	24	Sand Hill	31
Bn	Brownfield fine sand, thin surface	10	IVe-5	24	IIIe-7	24	Sandy Land	31
Br	Brownfield soils, moderately shallow	11	IVe-5	24	IIIe-7	24	Sandy Land	31
Bs	Brownfield soils, shallow	11	VIe-3	24	--------		Shallow Land	32
Bt3	Brownfield soils, severely eroded	11	VIIe-3	25	--------		Sand Hill	31
DrB	Drake soils, 1 to 3 percent slopes	12	IVe-2	23	IIIe-4	23	High Lime	31
DrC	Drake soils, 3 to 5 percent slopes	13	VIe-1	24	IVe-6	24	High Lime	31
DrE	Drake soils, 5 to 30 percent slopes	13	VIIe-1	25	--------		High Lime	31
Ga	Gomez and Arch soils	13	VIe-2	24	IVe-7	24	Sandy Flat	31
MfA	Mansker fine sandy loam, 0 to 1 percent slopes	14	IVe-4	23	IIIe-6	23	High Lime	31
MfB	Mansker fine sandy loam, 1 to 3 percent slopes	14	IVe-4	23	IIIe-6	23	Shallow Land	32
MfC	Mansker fine sandy loam, 3 to 5 percent slopes	14	VIe-1	24	IVe-6	24	Shallow Land	32
MlA	Mansker loam, 0 to 1 percent slopes	14	IVe-4	23	IIIe-6	23	High Lime	31
MlB	Mansker loam, 1 to 3 percent slopes	15	IVe-4	23	IIIe-6	23	Shallow Land	32
Mp	Mansker-Potter complex	15	VIe-3	24	--------		Shallow Land	32
PfA	Portales fine sandy loam, 0 to 1 percent slopes	15	IIIe-2	22	IIe-2	22	High Lime	31
PfB	Portales fine sandy loam, 1 to 3 percent slopes	16	IIIe-3	22	IIIe-3	22	High Lime	31
PlA	Portales loam, 0 to 1 percent slopes	16	IIIce-1	21	IIe-1	21	High Lime	31
Ps	Potter soils	17	VIIs-1	25	--------		Shallow Land	32
Rc	Randall clay	17	VIw-1	24	--------		Deep Hardland	32
Rf	Randall fine sandy loam	17	IVw-1	24	--------		Deep Hardland	32
Sc	Spur clay loam	18	IIIce-1	21	IIe-1	21	Bottom Land	31
Sf	Spur fine sandy loam	18	IIIe-2	22	IIe-2	22	Bottom Land	31
Sl	Spur loamy fine sand	18	IVe-3	23	IIIe-5	23	Bottom Land	31
Tv	Tivoli fine sand	18	VIIe-2	25	--------		Sand Hill	31
ZfA	Zita fine sandy loam, 0 to 1 percent slopes	19	IIIe-2	22	IIe-2	22	Mixed Land	31

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