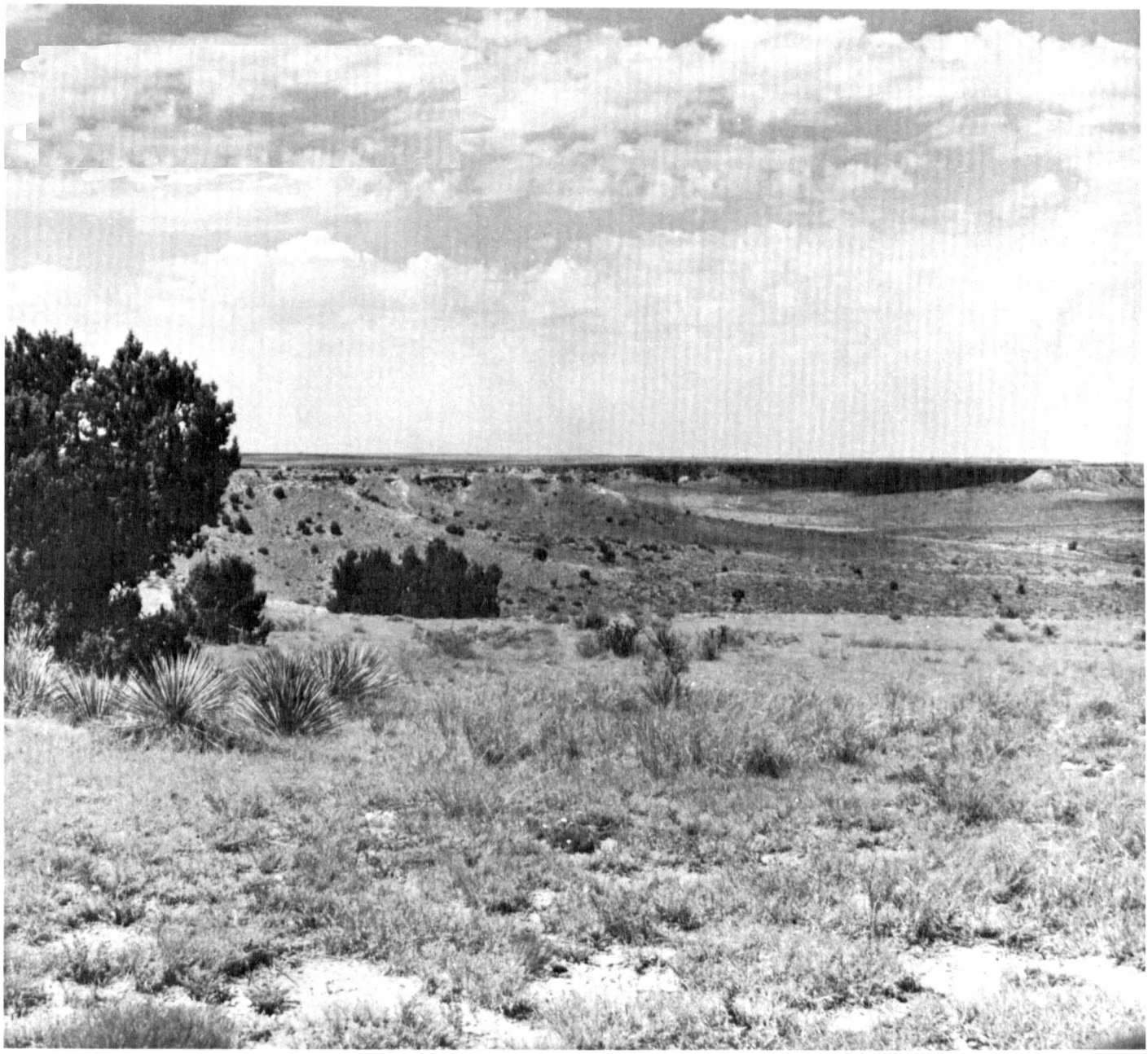
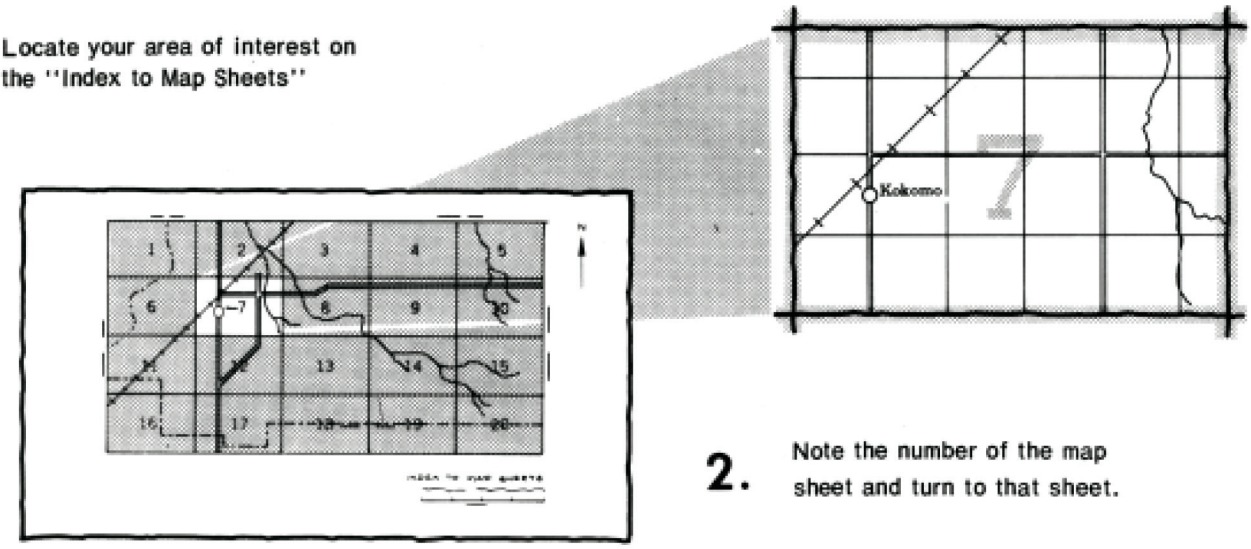


SOIL SURVEY OF
OLDHAM COUNTY, TEXAS

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

HOW TO USE

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



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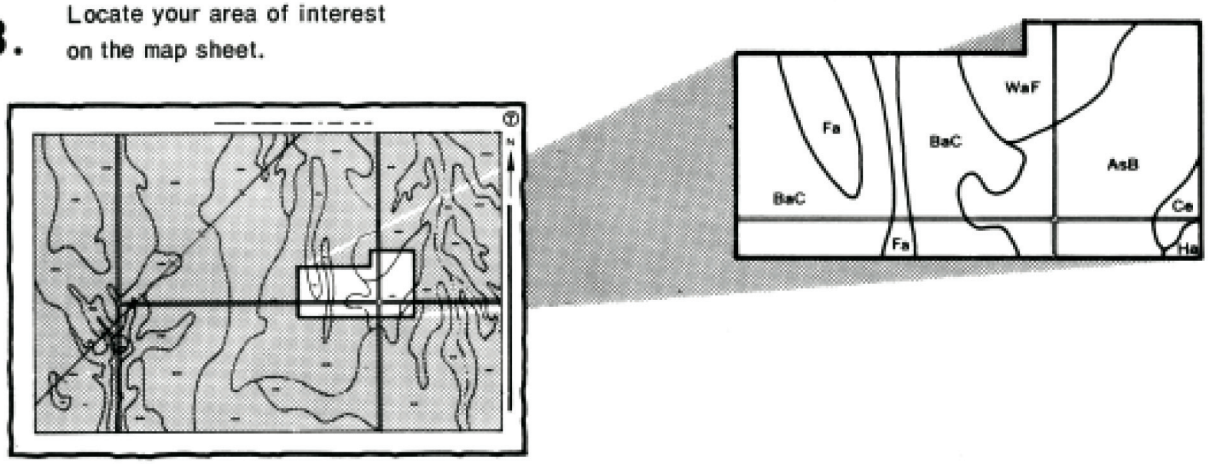

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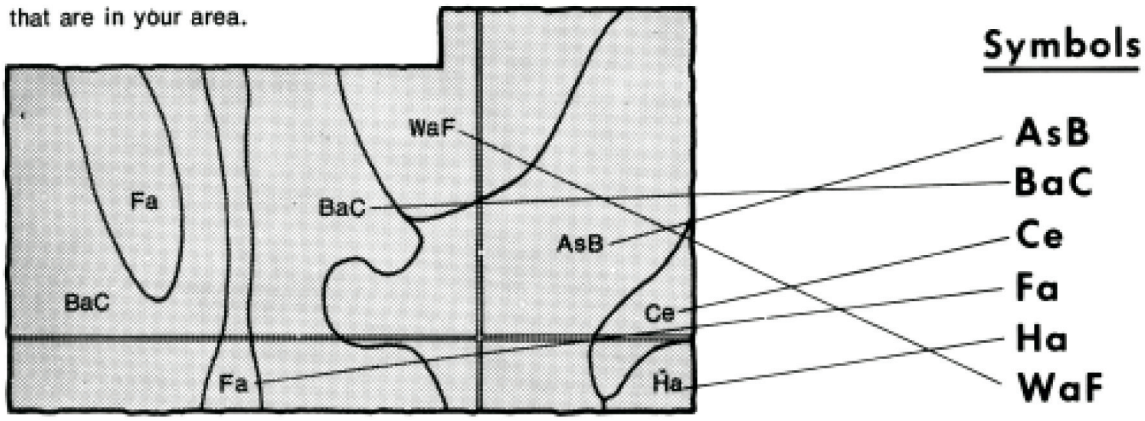
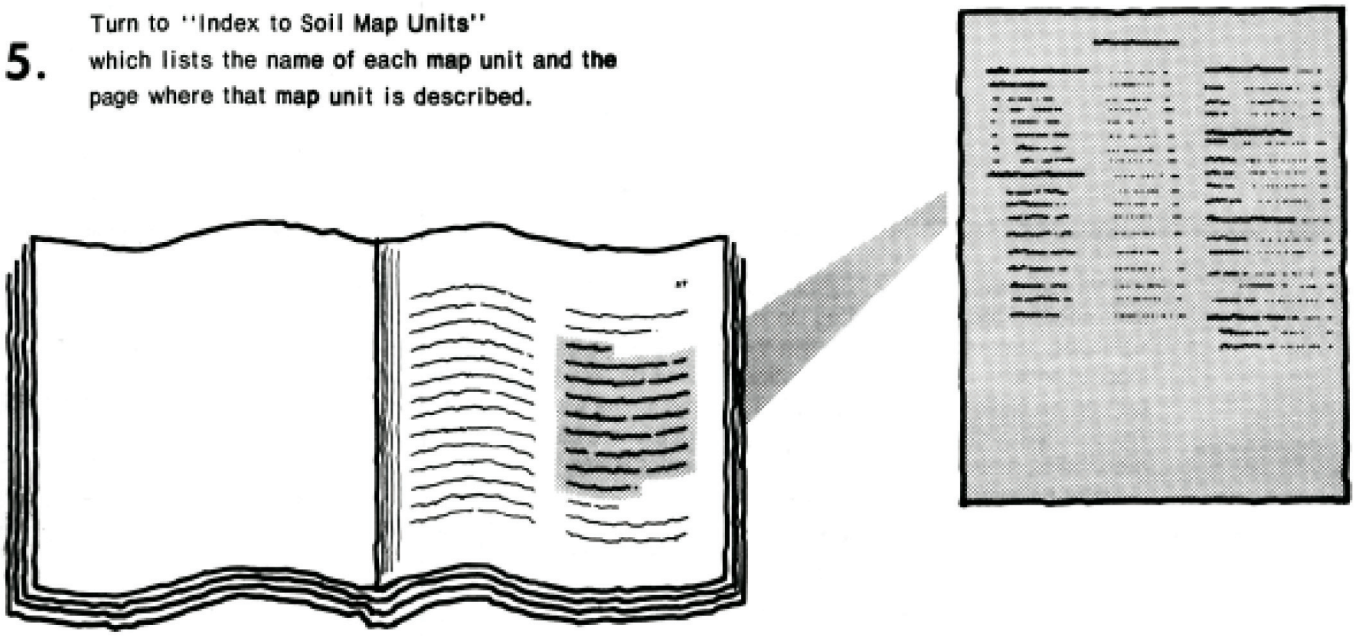
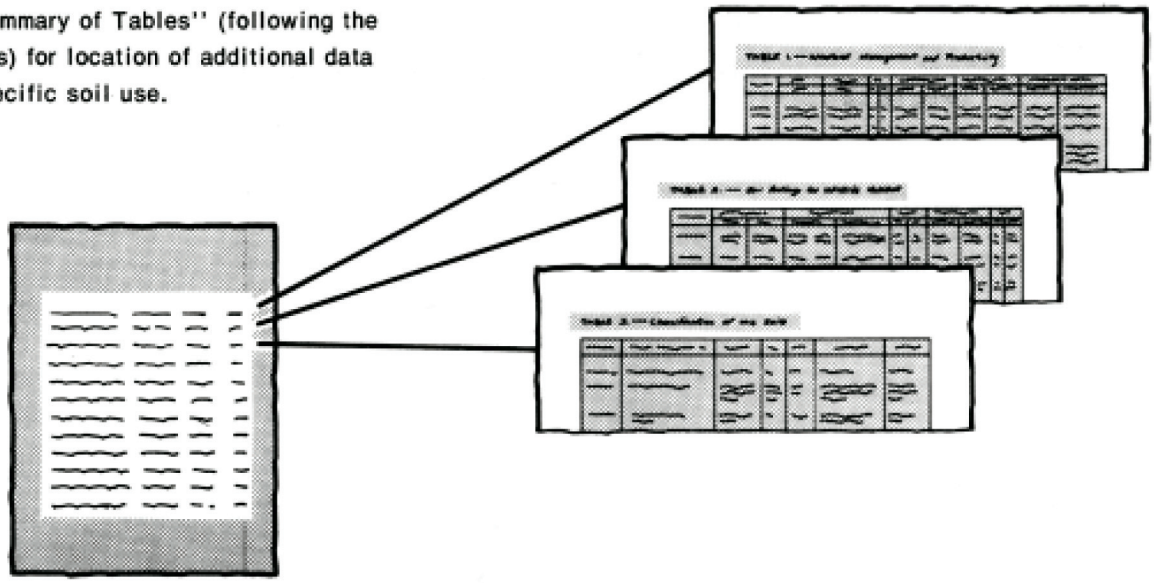


THIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1968-77. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Oldham County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: The soil in the foreground is Posey clay loam, 0 to 3 percent slopes. Along the caprock escarpment is the Potter-Mobeetie association, steep.

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foreword

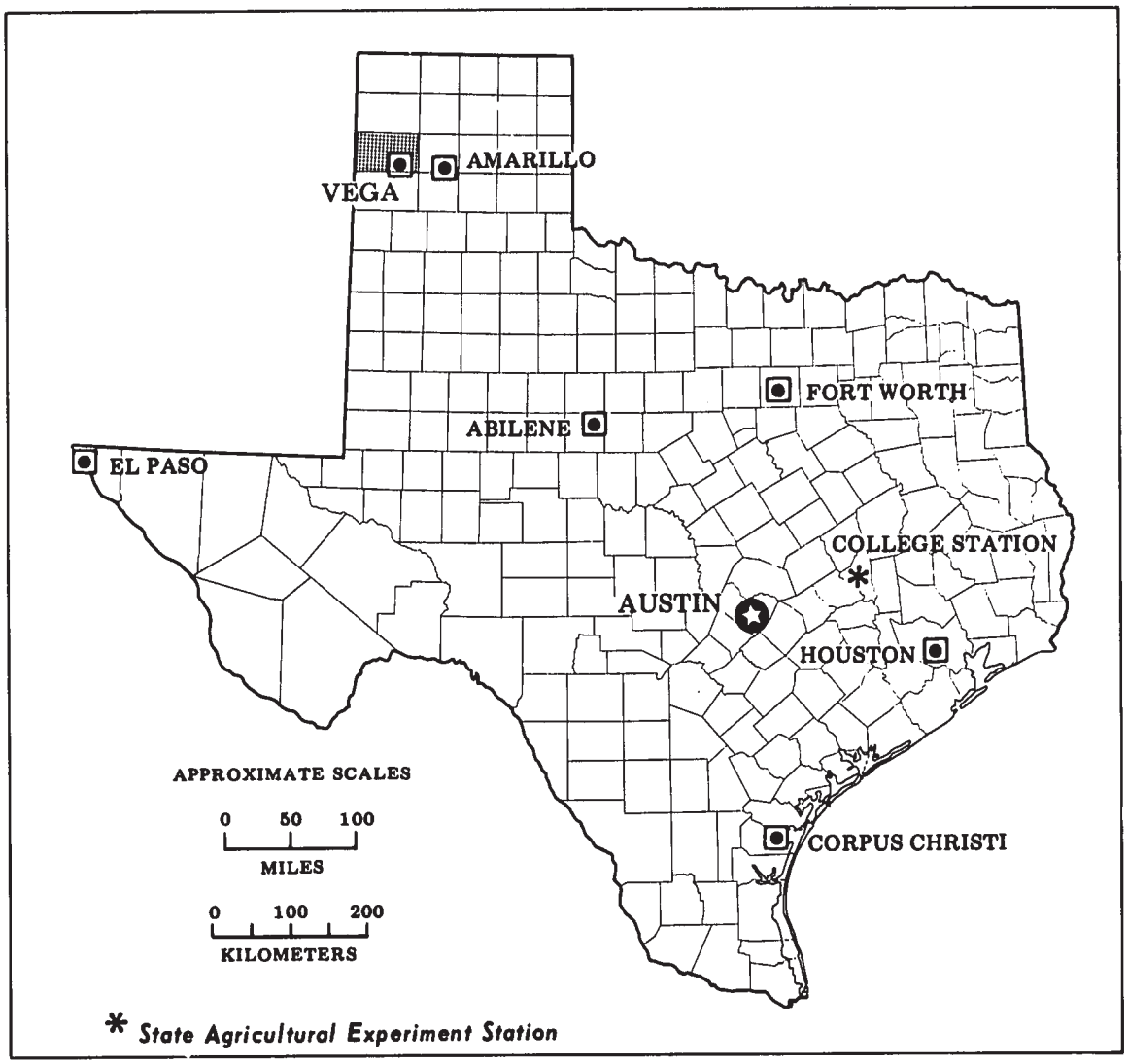
This soil survey contains information that can be used in land-planning programs in Oldham County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Oldham County in Texas.

soil survey of
Oldham County, Texas

By Fred B. Pringle, Soil Conservation Service

Fieldwork by Fred B. Pringle, Herbert E. Bruns, Luther C. Geiger, and Richard W. Fox, Soil Conservation Service

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

OLDHAM COUNTY is in the west-central part of the Texas Panhandle. The total area is 956,160 acres, or 1,494 square miles. The county is about 50 miles long and 30 miles wide. The elevation ranges from about 3,200 feet at Boys Ranch to 4,200 feet at Adrian. In 1975, the population was 2,711. It is gradually increasing.

Vega, the county seat, is about 35 miles west of Amarillo on Interstate Highway 40. The town serves a productive farming and ranching area.

Physiographically, the county is divided into two parts. The broad, smooth tableland of the High Plains makes up the southern and eastern parts. The rest is the rolling to steep land, locally known as the Canadian Breaks, that drains into the Canadian River.

The county is mainly in ranches. It is about 85 percent rangeland, 13 percent cropland, and 2 percent urban land and water areas (*5*). The raising of beef cattle is the main ranching enterprise. Grain sorghum and winter wheat are the principal crops. About one-fourth of the cropland is irrigated from deep wells.

general nature of the survey area

Oldham County was created from the Bexar District by an act of the Texas Legislature in 1876, and it was organized in 1881. It was named for William Simpson Oldham, Sr., a Confederate senator from Texas. It was the second county organized in the Texas Panhandle and the first established on the High Plains.

Tascosa, on Tascosa Creek near the Canadian River, was the original county seat. It was the second town founded in the panhandle, and it served as a supply center for the large ranches. With the coming of the railroad and the use of barbed wire, ranches on the High Plains became wheat farms. As more settlers arrived, three new towns were founded, all in the southern part of the county. These new towns—Adrian, Vega, and Wildorado—served the wheat farming areas. As these towns grew, they attracted trade from Tascosa. By 1915, the population of Tascosa had dwindled from 600 to only 15.

Vega, which had become the largest town in the county by 1911, became the county seat following an election in 1915. The towns of Adrian, Vega, and Wildorado continue to serve as supply centers and markets for the farmers of Oldham County.

On the pages that follow is general information on the agriculture of the county and the climate, natural resources, physiography, and transportation.

agriculture

Cattle ranching, irrigated farming, and dryland farming are the chief enterprises in Oldham County. Cropland and rangeland generally conform to the smooth High Plains and the rolling topography of the Canadian Breaks. Most of the cropland is on the High Plains.

Winter wheat and grain sorghum, dryfarmed and irrigated, are the most important crops. Wheat is grown mainly for grain, but much of the acreage is also used for winter pasture. Irrigation, which is very important to agriculture in the area, was introduced in the early 1950's.

The raising of beef cattle is the main ranching enterprise. Livestock operations are mainly cow-calf.

Considerable supplemental feed is needed for range cattle from about December through March.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Winter in Oldham County is alternately mild and very cool. Cold fronts repeatedly sweep over the area, causing sharp drops in temperature. The cold air behind these fronts moderates quickly. Winter precipitation, often snowfall, is light. Summers are hot. Total annual precipitation is usually adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Vega, Texas, in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 37 degrees F, and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Vega on February 1, 1951, is -17 degrees. In summer the average temperature is 75 degrees, and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred at Vega on June 30, 1957, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 18 inches. Of this, 13 inches, or 70 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 10 inches. The heaviest 1-day rainfall during the period of record was 6.07 inches at Vega on May 16, 1951. Thunderstorms occur on about 50 days each year, and most occur in summer.

Average seasonal snowfall is 21 inches. The greatest snow depth at any one time during the period of record was 33 inches. On an average of 8 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 40 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 80 percent of the time possible in summer and 70 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 15 miles per hour, in spring.

natural resources

Numerous wells supply water for approximately 30,000 acres of irrigated farmland in the county. The source of the underground water used for nearly all irrigation is the saturated sand and gravel at the base of the Ogallala Formation. The water table is declining because of an increase in consumption. There is little recharge from rainfall.

Sand and gravel mined commercially from the Ogallala Formation are mainly used in the construction industry. Caliche, which is plentiful in the county, is mined for use in local road construction.

Wildlife on the ranches and grainfields provides recreation for many residents.

physiography, relief, and drainage

Oldham County is in the southern part of the Great Plains, which extends from Texas into Canada. Most of the county lies in the valley of the Canadian River locally known as the Canadian Breaks. The river and its valley are the dominant topographical features of the county.

The Canadian Breaks is mostly an undulating to hilly landscape with some rougher areas of escarpments and canyons along the river and its tributaries. It makes up 82 percent of the county. In sharp contrast with the Breaks are the broad expanses of the smooth, featureless High Plains. The Canadian Breaks is in the northern part of Oldham County. The High Plains is in the southern part.

The Canadian Breaks is mostly in the Rolling Plains Land Resource Area. The landscape has rolling relief and a well developed drainage system. Other landforms in the Canadian Breaks, in addition to the escarpment along the edge of the High Plains, are a few scattered mesas and hills interspersed with flats and valley fills. Along both sides of the river are some windblown areas of hummocks and dunes.

The soils of the Rolling Plains formed under a cover of mid and short grasses. They are mainly light colored, loamy, and clayey.

The High Plains is a nearly level treeless plain that formed from Rocky Mountain outwash (*4*) and an overlying eolian mantle (*3*). Except where pitted by playas, the surface is remarkably smooth. The average grade of the High Plains is about 10 feet per mile to the southeast. Runoff follows a poorly defined pattern. Most runoff from the surrounding nearly level areas flows into the playas. These playas are dish shaped and range in size from less than 5 acres to several hundred acres.

The soils on the High Plains formed under a dense cover of short grasses. They are dominantly dark colored and loamy.

Management concerns are generally related to surface texture and slope. Unprotected areas are subject to soil blowing and water erosion. There are periods of drought, which are characteristic of the southern part of the Great Plains.

transportation

Oldham County is served by two major highways, U.S. Highway 385 and Interstate Highway 40. The southern part of the county is also served by Farm Roads 809 and 2858 and Texas Highway 290. Ranch Road 1961 crosses the northeastern part of the county. Most of the Canadian Breaks is served only by private ranch roads and trails.

The Chicago, Rock Island, and Pacific Railroad serves Wildorado, Vega, and Adrian.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, ranchers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

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

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Quay-Burson-Glenrio

Deep, very shallow and shallow, gently sloping to steep, calcareous loamy and clayey soils

The landscape of this map unit (fig. 1) is one of gently sloping to sloping Quay soils on smooth plains and interstream divides, moderately steep and steep Burson soils on slopes along draws and below escarpments, and sloping to strongly sloping Glenrio soils on sides of ridges and crests of knolls. The slope range is 5 to 40 percent.

This unit makes up about 26 percent of the county. It is about 45 percent Quay soils, 9 percent Burson soils, 8 percent Glenrio soils, and 38 percent minor soils.

The deep Quay soils typically have a reddish brown, moderately alkaline, calcareous silty clay loam surface layer about 8 inches thick. The subsoil, to 36 inches or more, is moderately alkaline, calcareous silty clay loam that is reddish brown in the upper few inches and light reddish brown below. The lower part has few to common films, threads, and soft masses of calcium carbonate. The underlying material to 66 inches is light reddish brown silty clay loam.

Typically, the very shallow Burson soils have a red, calcareous loam surface layer about 6 inches thick. The underlying material is red, weakly cemented sandstone.

Typically, the shallow Glenrio soils are reddish brown, calcareous clay to about 16 inches. Below 16 inches are alternating layers of reddish brown and light brownish gray clayey shale.

Of minor extent in this map unit are the Knoco, Latom, Montoya, and Clairemont soils. The very shallow, strongly sloping to steep Knoco soils are intermingled with areas of shale outcrop along escarpments. The shallow, gently sloping to strongly sloping Latom soils are intermingled with outcrops of sandstone on ridges. The deep, nearly level Montoya soils occupy stream terraces and slight depressions of the uplands. Clairemont soils are on bottom lands.

The soils in this unit are used as rangeland and wildlife habitat. The production potential for rangeland is medium. Good yields of short and mid grasses can be expected in favorable years. Because of the low, variable annual rainfall and lack of irrigation water, these soils are droughty and have very low potential for use as cropland. Also, many areas are inaccessible to farm machinery.

The potential is high for wildlife habitat. The steep, broken topography along the Canadian River and its tributaries provides an ideal refuge for mule deer and other kinds of wildlife. Antelope, quail, and turkey are common in the smoother areas.

This unit has low potential for most urban uses. The shrink-swell potential, low strength for roads and streets, high risk of corrosion to uncoated steel, and the slope are limitations that are difficult and costly to overcome. Also, many areas are inaccessible. This unit provides some good sites for recreation.

2. Mobeetie-Veal-Berda

Deep, gently sloping to strongly sloping, calcareous loamy soils

The landscape of this map unit (fig. 2) is one of rolling hills and ridges that are separated by small drainageways. The slope range is 3 to 12 percent. Mobeetie and Berda soils are on foot slopes below escarpments and on side slopes along draws. Veal soils are on convex ridgetops and low hills.

This unit makes up about 23 percent of the county. It is about 28 percent Mobeetie soils, 21 percent Veal soils, 15 percent Berda soils, and 36 percent minor soils.

Typically, the Mobeetie soils have a brown, calcareous fine sandy loam surface layer about 9 inches thick. The subsoil, to a depth of 45 inches, is calcareous fine sandy loam. The upper part is brown, and the lower part is light

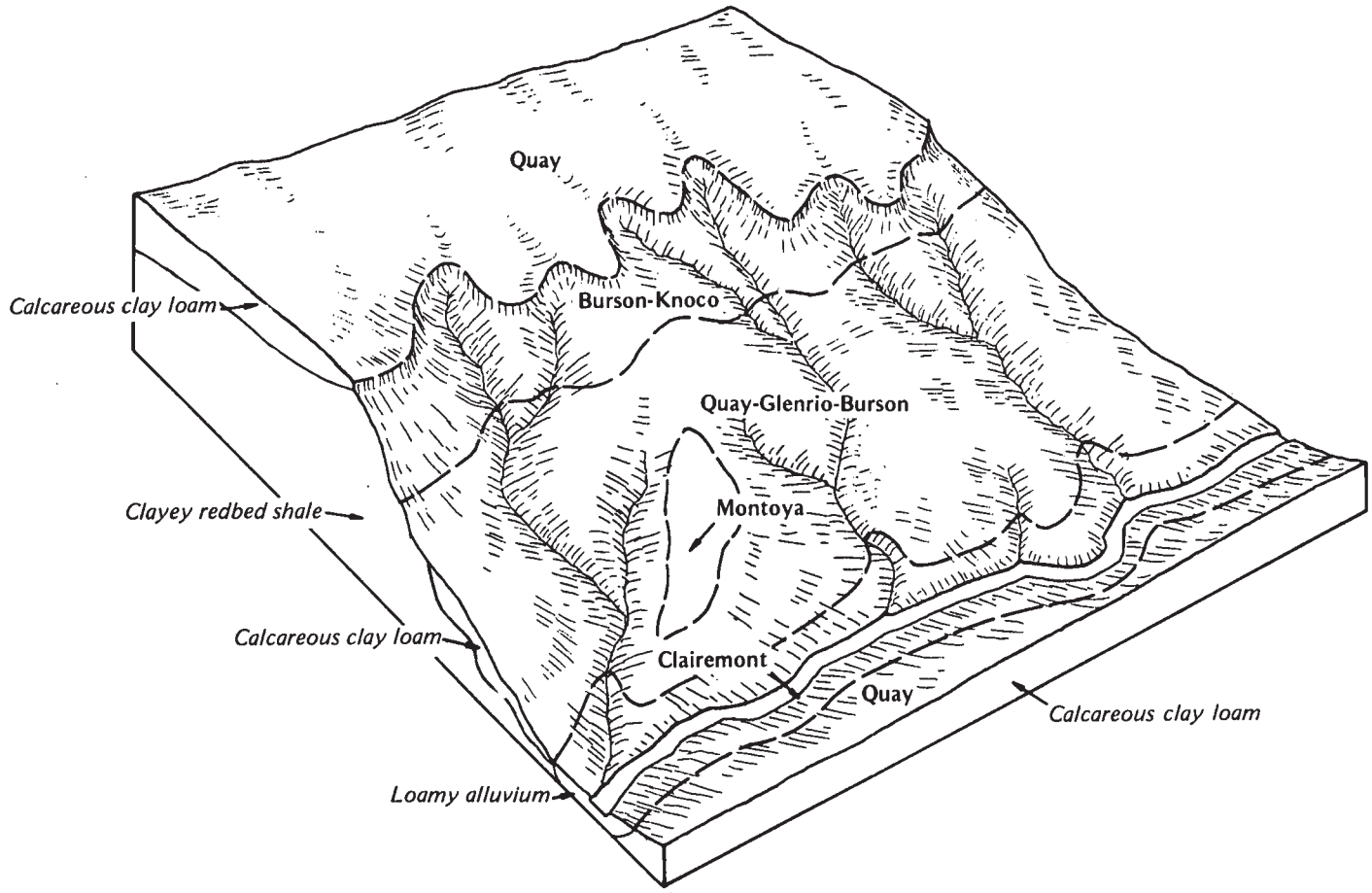


Figure 1.—Typical landscape of the Quay-Burson-Glenrio map unit.

brown. The underlying material to 60 inches is light brown, calcareous fine sandy loam.

Typically, the Veal soils have a brown, calcareous loam surface layer about 6 inches thick. The subsoil to 65 inches is calcareous clay loam. The upper part is light brown. The lower part is pinkish gray and is about 50 percent calcium carbonate.

Berda soils typically have a brown, calcareous loam surface layer about 8 inches thick. The subsoil to about 44 inches is light brown, calcareous clay loam. The substratum to 60 inches is brown, calcareous clay loam.

Of minor extent in this map unit are Acuff and Amarillo soils, which are on smooth interstream divides. Bippus and Spur soils are on valley floors and flood plains along streams. The gently sloping to sloping Likes soils are in hummocky areas adjacent to streams. The gently sloping Potter soils are on convex ridges. Tascosa soils are in hilly areas.

The soils in this unit are used chiefly as rangeland or wildlife habitat. The production potential for rangeland is medium. The slope and the high lime content of Veal soils make their use impractical for farming. Also, there is no dependable source of irrigation water. The potential for cropland use is low.

The potential is high for most urban uses. Slope is the main limitation. If well managed, most plants used in gardening and landscaping can be grown on these soils.

The potential is medium for wildlife habitat. The main species are antelope, mule deer, quail, and turkey. This unit provides some good sites for recreation.

3. Pullman

Deep, nearly level, noncalcareous loamy soils

The landscape of this map unit is one of broad, nearly level expanses of treeless plains. The plains are interrupted only by numerous playa basins. The slope range is 0 to 3 percent.

This unit makes up about 15 percent of the county. It is about 82 percent Pullman soils. The rest is minor soils.

Pullman soils typically have a brown, mildly alkaline clay loam surface layer about 5 inches thick. The subsoil to 40 inches is moderately alkaline clay that is dark brown in the upper part and brown in the lower part. From 40 to 55 inches, it is yellowish red, calcareous clay

loam. From 55 to 80 inches, it is pink, calcareous clay loam that is about 50 percent calcium carbonate.

Of minor extent in this map unit are Acuff, Olton, Estacado, Posey, Lipan, Lofton, and Randall soils. Acuff and Olton soils are in broad areas at the edge of the High Plains. Estacado and Posey soils are on slopes around playas (fig. 3). Lipan and Lofton soils are on benches around playa basins. Randall soils, on the playa bottoms, are periodically inundated by runoff.

This map unit is extensively cultivated. It includes most of the irrigated and dryfarmed cropland in the county. The soils have high potential for use as irrigated cropland. They are droughty unless irrigated. Because they are smooth, nearly level, and very slowly permeable, Pullman soils are well suited to surface irrigation. Little or no land leveling is needed.

This treeless, short-grass prairie has medium production potential for rangeland.

The high shrink-swell potential, high risk of corrosion to uncoated steel pipe, and low strength for roads and streets are limitations that are sometimes difficult and costly to overcome. Because of these limitations, the potential is medium for urban uses.

The potential is medium for openland and wildlife habitat. Crop stubble provides cover for pheasant, dove, and quail. Waste grain provides food in fall and winter.

Intermittent lakes in the playa basins provide suitable habitat for waterfowl. Antelope utilize areas adjacent to the Canadian Breaks.

4. Amarillo-Acuff

Deep, nearly level and gently sloping, noncalcareous loamy soils

The landscape of this map unit (fig. 4) is one of broad upland plains and interstream divides. The slope range is 0 to 5 percent.

This unit makes up about 11 percent of the county. It is about 54 percent Amarillo soils, 20 percent Acuff soils, and 26 percent minor soils.

Amarillo soils typically have a brown, mildly alkaline fine sandy loam surface layer about 8 inches thick. The subsoil to a depth of 38 inches is moderately alkaline sandy clay loam. It is reddish brown in the upper part and yellowish red below. From 38 to 80 inches, it is

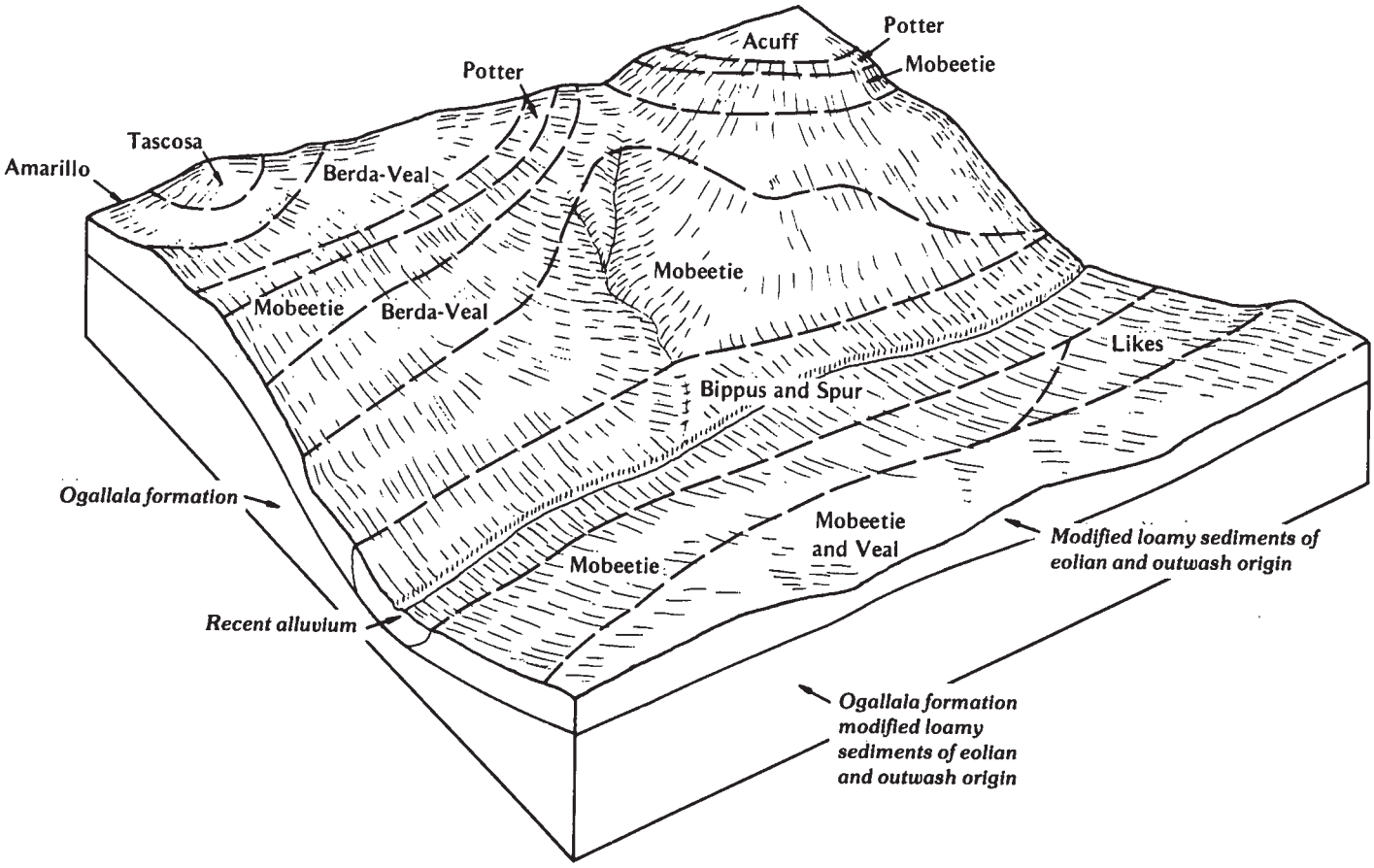


Figure 2.—Typical landscape of the Mobeetie-Veal-Berda map unit.

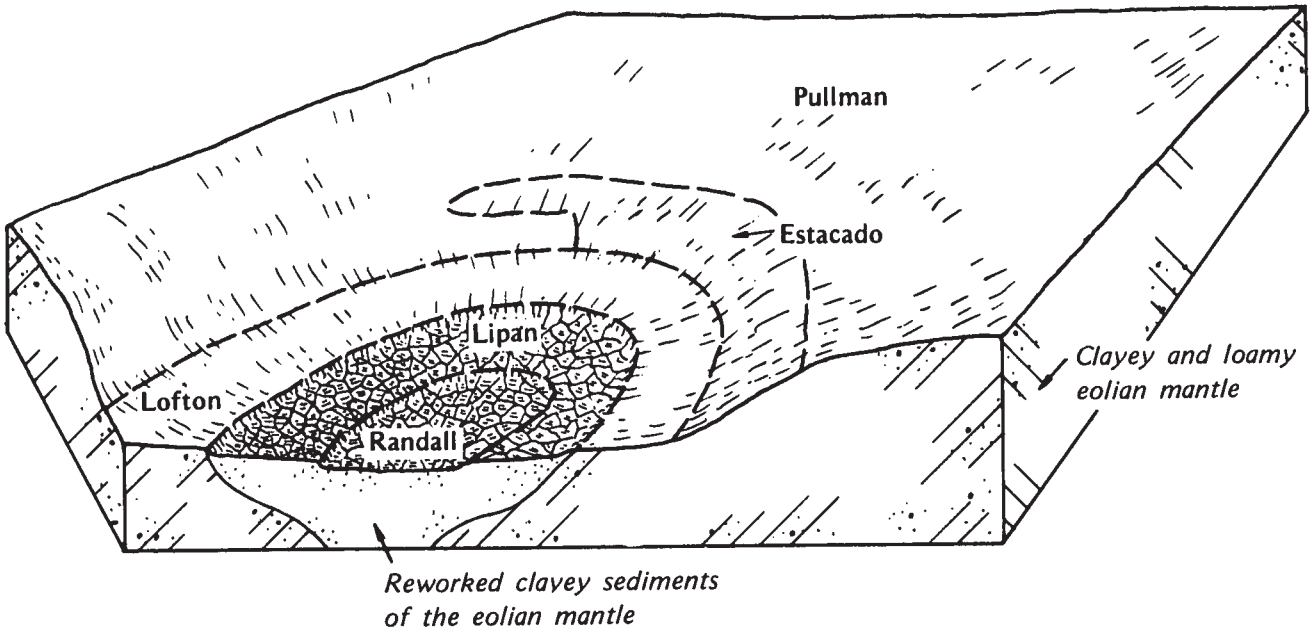


Figure 3.—Typical landscape of the Pullman map unit.

reddish yellow clay loam that is about 30 percent calcium carbonate.

Acuff soils typically have a dark brown, moderately alkaline loam surface layer about 11 inches thick. The subsoil to about 24 inches is brown, moderately alkaline clay loam. From 24 to 46 inches, it is yellowish red sandy clay loam. From 46 to 65 inches, it is pink clay loam that is about 40 percent calcium carbonate.

Of minor extent in this map unit are Berda, Mobeetie, Acuff, Estacado, Olton, and Springer soils. Berda and Mobeetie soils are on slopes along drainageways. The gently sloping Acuff, Estacado, and Olton soils are on smooth divides. Springer soils are on gently undulating divides.

The soils in this unit are used mainly as rangeland and wildlife habitat. The production potential is medium for rangeland. Good yields of mid and short grasses can be expected during favorable years. The potential is high for wildlife habitat. The unit provides adequate food and cover for antelope, quail, and turkey.

The potential is medium for cropland use. Slope, the hazard of soil blowing, low rainfall, and lack of irrigation water are the chief limitations.

The potential is high for urban uses. Slope, seepage, low strength for roads and streets, and the risk of corrosion to uncoated steel are the most limiting features. The limitations can be easily overcome with proper design and installation procedures. The potential is high for recreation.

5. Mobeetie-Tascosa

Deep, gently sloping to hilly, calcareous loamy and very gravelly soils

The landscape of this map unit (fig. 5) is mainly one of rolling to hilly country and well defined drainageways. Mobeetie soils are on the side slopes and foot slopes of hills and ridges. Tascosa soils are on the summits of knolls, hills, and ridges. The slope range is 3 to 40 percent.

This unit makes up about 10 percent of the county. It is about 40 percent Mobeetie soils, 39 percent Tascosa soils, and 21 percent minor soils.

Typically, the Mobeetie soils have a brown, calcareous fine sandy loam surface layer about 9 inches thick. The subsoil, to a depth of 45 inches, is calcareous fine sandy loam. The upper part is brown, and the lower part is light brown. The underlying material to about 60 inches is light brown, calcareous fine sandy loam.

Tascosa soils typically have a dark grayish brown, calcareous gravelly loam surface layer about 8 inches thick. The subsoil, to about 16 inches, is grayish brown, calcareous very gravelly loam. The underlying material to about 60 inches is very pale brown, calcareous very gravelly sandy loam.

Of minor extent in this map unit are Acuff, Amarillo, Bippus, Mobeetie, Likes, and Lincoln soils. Acuff and Amarillo soils are on interstream divides. The shallow Bippus soils are on valley floors. Mobeetie soils are on foot slopes. The sandy Likes soils are in hummocky areas. The sandy, nearly level Lincoln soils are on flood plains.

The soils in this unit are used as rangeland and wildlife habitat. The production potential is medium for rangeland. Yields of short and mid grasses are good during favorable years.

The potential is very low for cropland use. The slope and small stones or gravel are the main limitations.

The potential is low for most urban uses. The slope and small stones are limitations that are difficult to overcome. Some areas of Tascosa soils are a source of sand and gravel that is mined commercially for use in the construction industry.

The potential is medium for wildlife habitat. The chief species are mule deer and quail.

6. Olton-Acuff

Deep, nearly level and gently sloping, noncalcareous loamy soils

The landscape of this map unit is one of broad, smooth plains. The slope range is 0 to 5 percent. This unit makes up about 6 percent of the county. It is about 41 percent Olton soils and 33 percent Acuff soils. The rest is minor soils.

Olton soils typically have a dark brown clay loam surface layer about 6 inches thick. The subsoil is moderately alkaline clay loam more than 60 inches thick. It is dark brown in the upper few inches grading to reddish brown below. From 30 to 60 inches, it is yellowish red and calcareous. From 60 to 65 inches, it is pink, calcareous clay loam that is about 20 percent calcium carbonate.

Acuff soils typically have a dark brown loam surface layer about 11 inches thick. The subsoil, to a depth of 24 inches, is clay loam that is dark brown in the upper part and brown in the lower part. Between 24 and 46 inches, it is yellowish red, calcareous sandy clay loam. From 46 to about 65 inches, it is pink, calcareous clay loam that is about 40 percent calcium carbonate.

Of minor extent in this map unit are Bippus, Estacado, Mobeetie, Posey, and Veal soils. The shallow Bippus soils are in valleys and along streams. Estacado and Posey soils are on divides and on side slopes of ridges.

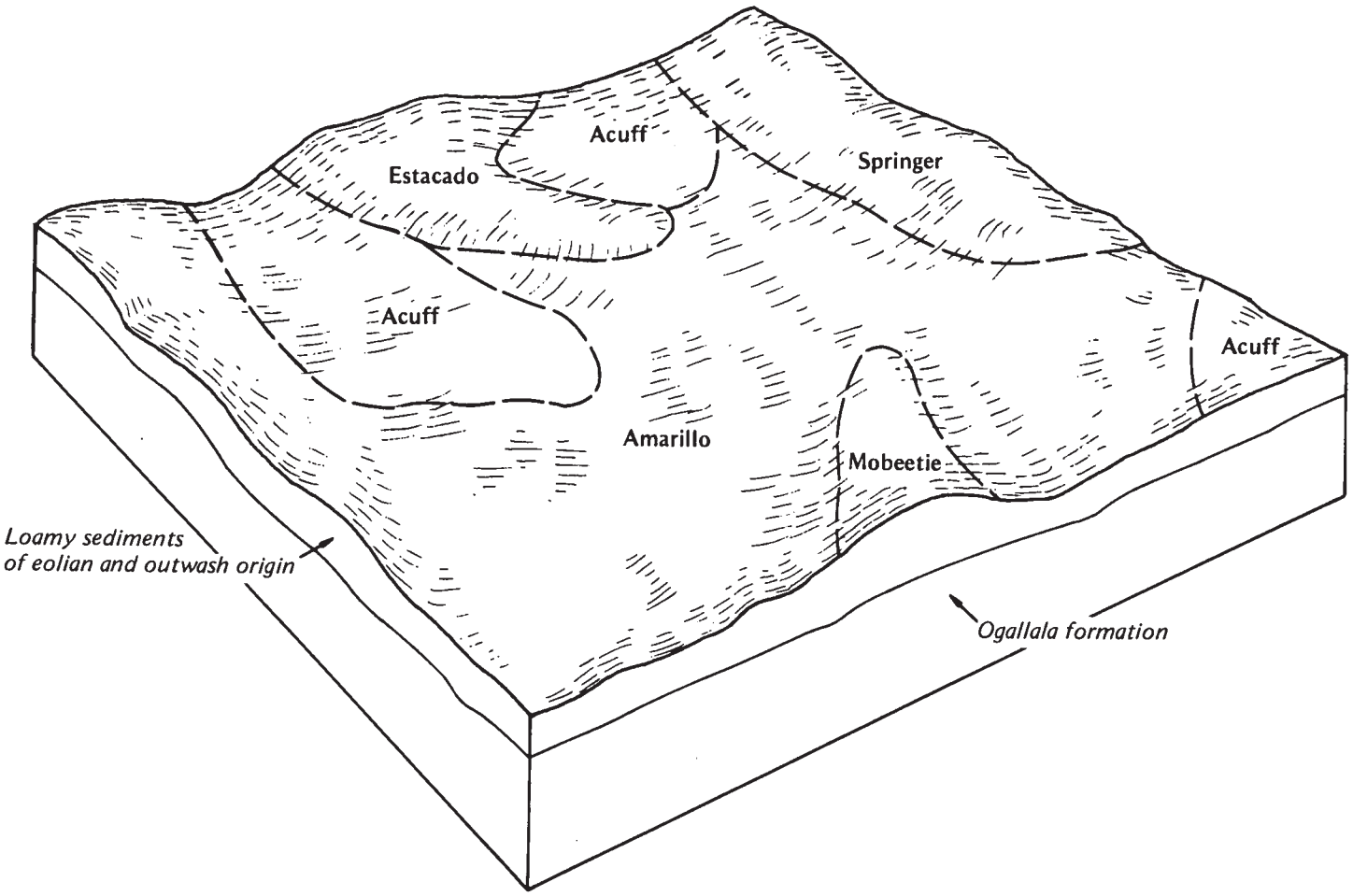


Figure 4.—Typical landscape of the Amarillo-Acuff map unit.

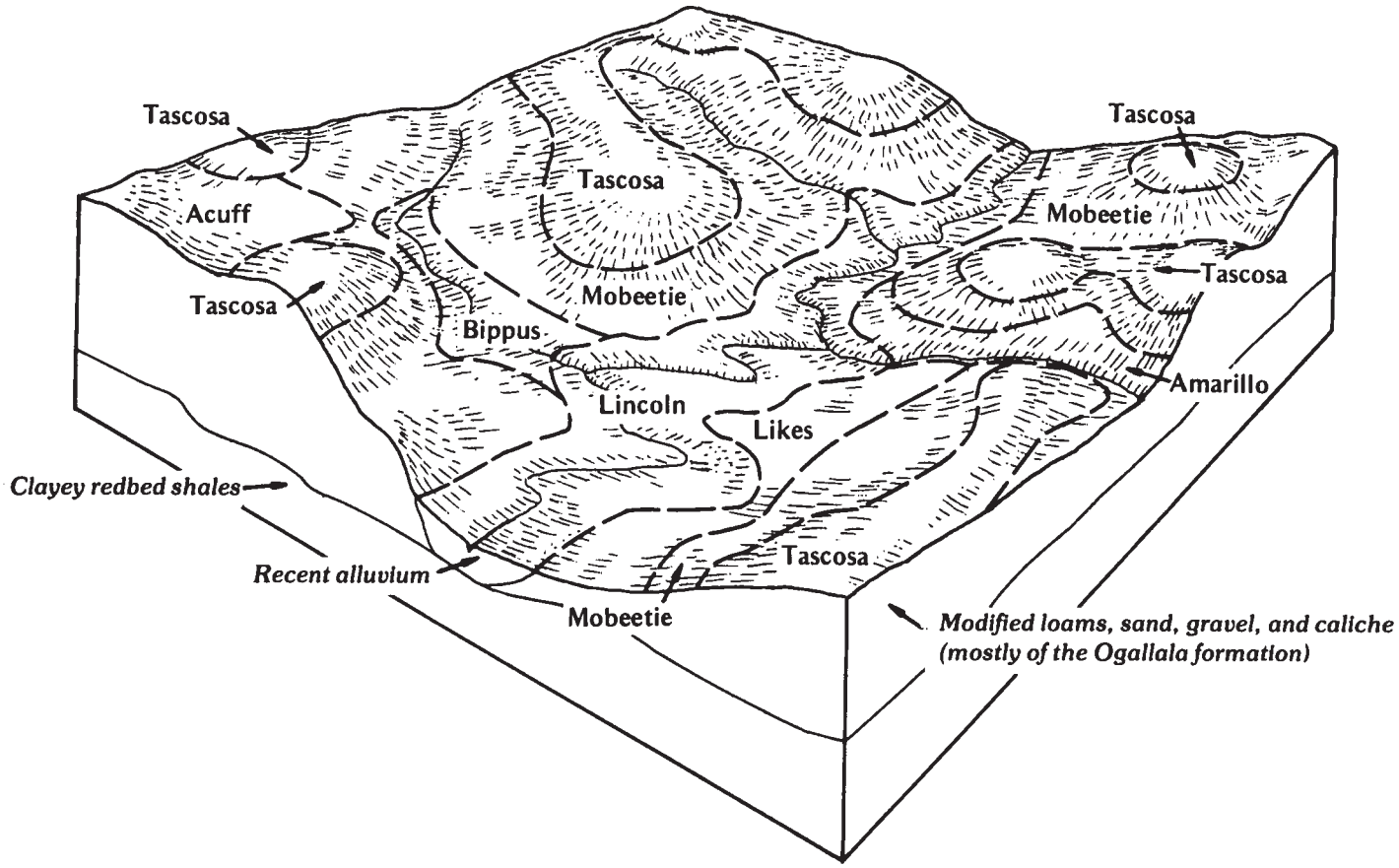


Figure 5.—Typical landscape of the Mobeetie-Tascosa map unit.

Mobeetie soils are on foot slopes and side slopes along draws. Veal soils are on ridges and knolls.

The soils in this unit are used mainly as rangeland and wildlife habitat. The production potential is medium for rangeland. Good yields of short grasses can be expected in favorable years.

The potential is medium for wildlife habitat. Antelope, quail, and turkey are the dominant species.

The potential is medium for cropland use. The low, variable annual rainfall and an inadequate supply of irrigation water are the main limitations.

The potential is medium for urban uses. Low strength for roads and streets and the shrink-swell potential can cause problems. Proper design and installation procedures are needed. The potential is medium for recreation.

7. Estacado-Posey

Deep, nearly level and gently sloping, calcareous loamy soils

The landscape of this map unit is one of smooth plains and slopes along draws and around playas. The slope range is 0 to 5 percent.

This unit makes up about 3 percent of the county. It is about 60 percent Estacado soils and 25 percent Posey soils. The rest is minor soils.

Estacado soils typically are calcareous clay loam to 60 inches. The surface layer and upper part of the subsoil are brown. The lower part of the subsoil is yellowish red to pink. This soil is 30 to 50 percent calcium carbonate below 30 inches.

Posey soils typically are calcareous clay loam to more than 60 inches. Below about 18 inches the soil is 15 to 20 percent calcium carbonate. The surface layer is typically brown. The upper part of the subsoil is reddish yellow, and the lower part is yellowish red to reddish brown.

Of minor extent in this map unit are Acuff, Olton, Pullman, Bippus, and Potter soils. Acuff, Olton, and Pullman soils are on the smooth, broad upland plains. The shallow Bippus soils are on valley floors and along streams. Potter soils are on ridges.

The soils in this unit are used as cropland and rangeland. Areas on the High Plains are extensively farmed. Areas that border the Canadian Breaks are used mainly as rangeland.

The potential for cropland use is medium if the soil is

irrigated. The low, variable annual rainfall and lack of water for irrigation are the main limitations. Also, the high lime content of all these soils causes chlorosis, or yellowing of the leaves, in some crops.

The production potential is medium for rangeland. Good yields of mid and short grasses can be expected during favorable years.

The potential is medium for most urban uses. Low strength, which affects roads and streets, excess lime and its effect on growing plants, and the clay loam surface texture are the main limitations.

The potential for openland wildlife habitat is medium. Crop stubble provides cover for pheasant, dove, and quail. Waste grain provides some food in fall and winter. Antelope utilize the range adjacent to the Canadian Breaks.

8. Likes-Tivoli

Deep, undulating to hummocky and duned, calcareous and noncalcareous sandy soils

The landscape of this map unit is one of undulating to rolling hummocks and dunes in windblown areas adjacent to the Canadian River and its larger tributaries. The slope range is 1 to 12 percent.

This map unit makes up about 3 percent of the county. It is about 55 percent Likes soils and 25 percent Tivoli soils. The rest is minor soils.

Likes soils typically are brownish, calcareous loamy fine sand to 60 inches or more.

Tivoli soils typically are brownish fine sand to 60 inches or more.

Of minor extent in this map unit are Amarillo, Springer, Lincoln, and Mobeetie soils. Amarillo and Springer soils are in interdune areas. Lincoln soils are on flood plains along streams. Mobeetie soils are on foot slopes and slopes along streams.

The soils in this unit are used as rangeland. The production potential is medium. The hazard of soil blowing is so severe that the potential for farming is very low.

The potential for urban uses is low. Slope and the sandy surface texture are the main limitations. The hazard of soil blowing reduces the desirability of these soils as building sites. The potential for recreation is low.

9. Potter-Mobeetie

Very shallow and deep, sloping to steep, calcareous gravelly and loamy soils

The topography is one of caliche escarpments and colluvial foot slopes that border the High Plains. The sloping to steep Potter soils are on convex ridges and nearly vertical escarpments. The sloping to strongly sloping Mobeetie soils are on the foot slopes below. The slope range is 5 to 40 percent.

This map unit makes up about 2 percent of the county. It is about 45 percent Potter soils and 30 percent Mobeetie soils. About 25 percent is minor soils.

The surface layer of Potter soils is typically brown, calcareous gravelly loam about 8 inches thick. The underlying material is white caliche.

Typically, the Mobeetie soils have a brown, calcareous fine sandy loam surface layer about 9 inches thick. The subsoil, to a depth of 45 inches, is calcareous fine sandy loam. The upper part is brown, and the lower part is light brown. The substratum to 60 inches is light brown, calcareous fine sandy loam.

Minor soils in this unit are Veal soils on low ridges, Bippus soils on outwash fans, Posey soils on plains and divides, and Quay soils on foot slopes.

The soils in this unit are used entirely as rangeland and wildlife habitat. The production potential is low for rangeland. It is difficult for cattle to graze the steeper, rougher parts of the terrain.

The potential is medium for habitat for rangeland wildlife. The escarpments provide good habitat for mule deer.

The potential is very low for urban uses. Shallowness over rock and the steep slopes are severe limitations. Potter soils are a major source of caliche used in roadbuilding. Some areas provide scenic sites for recreation.

broad land use considerations

The map units in the county vary widely in their potential for major land uses, as indicated in table 4. For each land use, general ratings of the potential of each map unit as related to the potential of the other map units are indicated. Also indicated are general soil limitations. The ratings of soil potential reflect the relative cost of such practices and also the hazard of soil related problems after such practices are installed. Not considered is the location as related to existing transportation systems or other facilities.

The kinds of land uses considered are irrigated cropland, nonirrigated cropland, rangeland, urban uses, and recreation. Cultivated crops grown extensively include grain sorghum and wheat. Specialty crops include vegetables and nursery crops grown on a limited acreage and generally requiring intensive management. Rangeland refers to land in native grass. Urban uses are residential, commercial, and industrial development. Recreation areas are campsites, picnic areas, playgrounds, paths and trails, nature study trails, and wilderness areas.

Most map units can be used for urban development. A small part of each unit, however, has playas, drainageways, or flood plains where inundation or flash flooding is a severe hazard.

Urban development is costly on the soils of the Pullman unit that have high shrink-swell potential, on the hilly gravelly soils of the Mobeetie-Tascosa unit, and on

the sloping clayey soils of the Quay-Burson-Glenrio unit, which are high in shrink-swell potential. The steep, rough, very shallow soils of the Potter-Mobeetie unit impose limitations that are difficult and costly to overcome. This unit has very low potential for urban development.

Some of the map units can be developed for urban use at a lower cost than the soils mentioned in the preceding paragraph. These are the Amarillo-Acuff, Mobeetie-Veal-Berda, and Estacado-Posey units.

The soils of the Pullman map unit have high potential for irrigated crops, but medium potential for urban development. In most areas they have high potential for irrigated specialty crops. The high shrink-swell potential, the low strength, which affects local roads and streets, and the high risk of corrosion to uncoated steel pipe are limitations to nonfarm development. These limitations can be overcome by good design and construction of foundations, storm drainage systems, and roadbeds.

The soils in the rough, rugged areas of the Quay-Burson-Glenrio and Potter-Mobeetie units have good potential for parks and recreation areas. The nearly vertical canyon walls, raw gorges, escarpments, and canyons provide some of the most scenic areas in the county. Some parts of these units are good for nature study areas and also serve as habitat for many important wildlife species.

Soil information can be used as a guide in planning the orderly growth and development of the county. It is especially helpful in determining land that can be allocated to each use.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Amarillo fine sandy loam, 1 to 3 percent slopes, is one of several phases in the Amarillo series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Latom-Rock outcrop complex, 3 to 15 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Mobeetie-Tascosa association, rolling, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Spur and Bippus soils, frequently flooded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Acuff loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on broad interstream divides and plains in the Canadian Breaks. Slopes are smooth and slightly convex and average about 0.6 percent. Most areas are oval and range from 50 to 300 acres.

Typically, the surface layer is a dark brown, mildly alkaline loam about 12 inches thick. The subsoil is about 68 inches thick. The upper 18 inches is brown, mildly alkaline clay loam. The next 10 inches is light brown, moderately alkaline clay loam that is about 30 percent calcium carbonate. The lower 40 inches is light brown, moderately alkaline sandy clay loam.

Under native range this soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. Runoff is slow. The hazards of water

erosion and soil blowing are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Amarillo, Estacado, and Olton soils. Also included are a few small areas of Acuff loam that has slopes of 1 to 3 percent. The included soils make up less than 15 percent of a mapped area.

The chief use of this soil is rangeland. The production potential is medium. The climax plant community is mainly short grasses and lesser amounts of mid grasses and perennial forbs. Good management includes proper stocking and controlled grazing.

Small areas of this soil are used for crops, mainly winter wheat and grain sorghum. In most of these areas the soil is dryfarmed. In a few it is irrigated. The potential for row crops and small grain is high if the soil is irrigated. Adequate amounts of crop residue on the soil surface and timely and limited tillage are effective in conserving moisture, slowing runoff, reducing soil blowing, and maintaining tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The potential is high for all urban uses. Low strength, which affects roads and streets, is the only limitation and can easily be overcome by good design and careful installation.

The capability subclass is IIIe, dryland, and IIe, irrigated. The range site is Clay Loam.

2—Acuff loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on broad ridges, divides, and slopes along drains in the Canadian Breaks and along the margins of the High Plains. Slopes are convex and average about 2 percent. Areas are long ovals ranging from 10 to 300 acres.

Typically, the surface layer is a dark brown loam about 11 inches thick. The subsoil, to a depth of 24 inches, is brown clay loam. The next 22 inches is yellowish red sandy clay loam. Below this, to 65 inches, is pink clay loam that is about 40 percent calcium carbonate. The soil is typically moderately alkaline throughout.

Under native range this soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of water erosion is moderate. The susceptibility to soil blowing is slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Amarillo, Estacado, Olton, and Quay soils. Also included are small areas of Acuff soils that have slopes of 3 to 5 percent. The included soils make up less than 15 percent of a mapped area.

This soil is used mostly as rangeland. The production potential is medium. The climax plant community consists mainly of short grasses and small amounts of mid grasses and perennial forbs. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain production.

A few small areas are used for winter wheat, grain sorghum, and forage sorghum. In most of these areas the soil is dryfarmed. A small acreage is irrigated. The potential for row crops and small grain is high in irrigated areas. Management is needed to reduce the hazard of water erosion.

Terraces, contour farming, and waterways are needed in some places. Crop residue left on the soil surface and timely and limited tillage help to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The potential is high for all urban uses. Low strength, which affects roads and streets, is the only limitation and can easily be overcome by good design and careful installation.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Clay Loam.

3—Acuff loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on slopes along draws in the Canadian Breaks. Slopes are convex. The dominant gradient is about 4 percent. Areas are long bands that range from 10 to 200 acres.

Typically, the surface layer is dark brown loam about 11 inches thick. To 68 inches the subsoil is clay loam that is brown in the upper part, reddish brown in the middle part, and yellowish red and about 25 percent calcium carbonate in the lower part. From 68 to 80 inches it is reddish yellow sandy clay loam that is about 20 percent calcium carbonate. The soil is mildly alkaline in the upper part and moderately alkaline in the lower part.

Under native range this soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of water erosion is severe. Susceptibility to soil blowing is slight. Roots easily penetrate the deep root zone of this soil.

Included in some mapped areas are small areas of Amarillo, Estacado, and Posey soils. Also included are a few small gravelly knolls of Tascosa soils. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. The production potential is medium. The climax plant community is mainly short grasses and small amounts of mid grasses and forbs. Good management includes proper stocking and controlled grazing.

A few small areas are used for winter wheat and forage sorghum. The potential for cultivated crops is medium. It is high if the soil is irrigated. Terraces, waterways, and contour farming are needed to reduce the hazard of water erosion. Close spaced high-residue crops provide adequate cover and residue to protect the soil. Crop residue should be left on the soil surface and tillage kept to a minimum to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

This soil has high potential for urban uses. Low strength, which affects roads and streets, and slope are the only limitations. These limitations can be easily overcome by good design and careful installation.

The capability subclass is IVe, dryland, and IVe, irrigated. The range site is Clay Loam.

4—Amarillo loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and gently sloping, well drained soil is on broad divides and plains. Slopes are mainly convex. The gradient is dominantly about 2 percent. Most areas are oval and range from 25 to 400 acres in size.

Typically, the surface layer is a brown, mildly alkaline loamy fine sand about 9 inches thick. The subsoil, to a depth of 24 inches, is reddish brown, mildly alkaline sandy clay loam. From 24 to 37 inches it is yellowish red, moderately alkaline sandy clay loam. From 37 to 60 inches it is pink, moderately alkaline sandy clay loam that contains about 25 percent calcium carbonate.

Under native range this soil is low in natural fertility. Permeability is moderate, and the available water capacity is medium. Runoff is slow. In unprotected areas the hazard of water erosion is moderate and susceptibility to soil blowing is severe. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Acuff, Berda, Springer, Tivoli, and Veal soils and some areas of Amarillo fine sandy loam, 0 to 5 percent slopes. Included soils make up less than 15 percent of a mapped area.

All the acreage is rangeland (fig. 6). The production potential is medium. The climax plant community is mid and short grasses along with a few scattered shrubs.

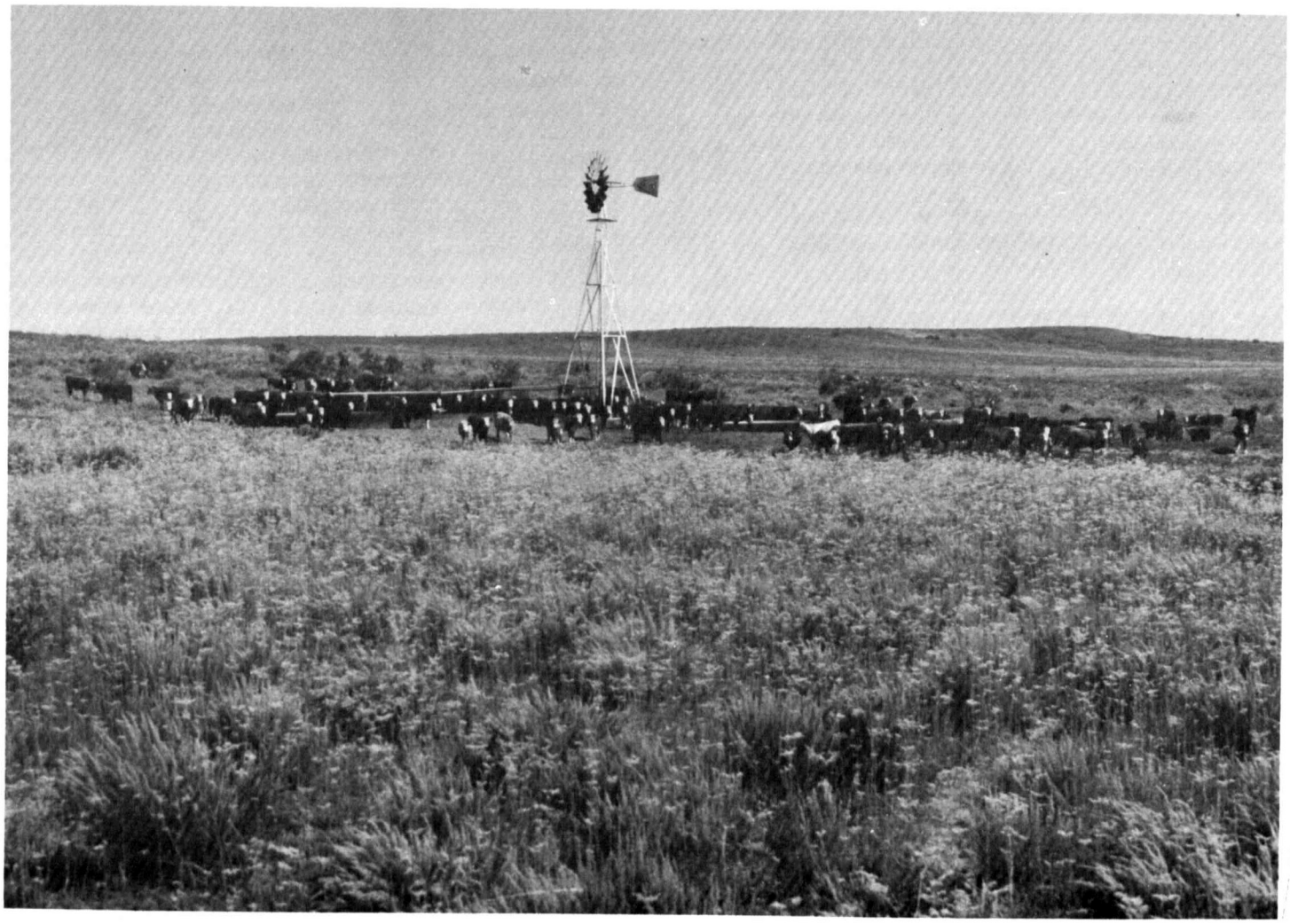


Figure 6.—Area of Amarillo loamy fine sand, 0 to 3 percent slopes. This soil is in the Loamy Sand range site.

This soil is not used for cultivated crops. The potential is medium for winter wheat, grain sorghum, and forage sorghum. Management is needed to reduce the hazards of water erosion and soil blowing. Crop residue left on the soil surface and minimum tillage help to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth.

The potential is high for urban uses. The only limitation is low strength, which affects roads and streets. It can be easily overcome by good planning, proper design, and careful installation.

The capability subclass is IVe, dryland, and IIIe, irrigated. The range site is Loamy Sand.

5—Amarillo fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad plains and divides in the Canadian Breaks. Slopes are smooth and slightly convex. Most areas are oval and range from 30 to 500 acres.

Typically, the surface layer is brown, mildly alkaline fine sandy loam about 9 inches thick. The subsoil, to a depth of 38 inches, is yellowish red, moderately alkaline sandy clay loam. From 38 to 60 inches it is reddish yellow, moderately alkaline clay loam that is about 35 percent calcium carbonate.

Under native range this soil is medium in natural fertility. Permeability is moderate, and the available water capacity is medium. Runoff is slow. In unprotected areas, the hazard of water erosion is slight and susceptibility to soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Acuff, Estacado, Mobeetie, and Veal soils. Also included are a few areas of Amarillo fine sandy loam, 1 to 3 percent slopes. These included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. The production potential is medium. Rangeland supports moderately dense stands of short grasses and lesser amounts of mid grasses and scattered shrubs. Management includes proper stocking, uniform grazing, and brush control.

A few areas are used for winter wheat, grain sorghum, and forage sorghum. In most of these areas the soil is dryfarmed, but a few small areas are irrigated. The potential for cultivated crops is high if the soil is irrigated. Management is needed to reduce the hazards of water erosion and soil blowing. Adequate amounts of crop residue on the soil surface and timely and limited tillage are effective in conserving moisture, slowing runoff, reducing soil blowing, and maintaining tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The potential for all urban uses is high. Low strength, which affects roads and streets, is the only limitation and can be easily overcome by good design and careful installation.

The capability subclass is IIIe, dryland, and IIe, irrigated. The range site is Sandy Loam.

6—Amarillo fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on broad divides, ridges, and slopes along draws in the Canadian Breaks. Slopes are convex. The gradient is dominantly about 2 percent. Most areas are long ovals that range from 20 to 500 acres.

Typically, the surface layer is a brown, mildly alkaline fine sandy loam about 8 inches thick. The subsoil, from 8 to 18 inches, is reddish brown, moderately alkaline sandy clay loam. From 18 to 38 inches it is yellowish red, moderately alkaline clay loam. From 38 to 80 inches it is reddish yellow, moderately alkaline clay loam that is about 30 percent calcium carbonate.

Under native range this soil is medium in natural fertility. Permeability is moderate, and the available water capacity is medium. Runoff is medium. In unprotected areas the hazard of water erosion is moderate and susceptibility to soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Acuff, Estacado, Mobeetie, and Veal soils and a few areas of Amarillo fine sandy loam, 3 to 5 percent slopes. These included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. The production potential is medium. Rangeland supports moderately dense stands of short grasses and scattered mid grasses and small shrubs. Good management includes proper stocking, controlled grazing, and brush control.

A few areas are used for winter wheat, grain sorghum, and forage sorghum. The soil is mainly dryfarmed. The potential for cultivated crops is high if the soil is irrigated. Management is needed to reduce the hazards of water erosion and soil blowing. In places, terraces, waterways, and contour farming are needed. Crop residue left on the soil surface and minimum tillage help to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth. If the soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

For urban uses, this soil has high potential. Low strength, which affects roads and streets, is the only limitation. It can be easily overcome by good planning, proper design, and careful installation.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Sandy Loam.

7—Amarillo fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on convex slopes along drains in the Canadian Breaks. Areas are long bands that range from 10 to 200 acres.

Typically, the surface layer is about 8 inches of reddish brown, mildly alkaline fine sandy loam. The subsoil, to a depth of 48 inches, is reddish brown, moderately alkaline sandy clay loam. Below this to 80 inches, it is yellowish red, moderately alkaline sandy clay loam that contains about 25 percent calcium carbonate.

Under native range this soil is medium in natural fertility. Permeability is moderate, and the available water

capacity is medium. Runoff is medium, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. Roots easily penetrate the deep root zone of this soil.

Included in some mapped areas are small areas of Acuff, Estacado, Mobeetie, and Veal soils; a few eroded areas; and a few small areas of Amarillo fine sandy loam, 1 to 3 percent slopes. The included soils make up less than 15 percent of a mapped area.

This soil is used mainly as rangeland. The production potential is medium. The climax plant community is mainly short grasses and small amounts of mid grasses and forbs. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain production.

A few small areas are used for winter wheat and forage sorghum. The soil is mainly dryfarmed; the potential is medium for cropland use. Terraces, waterways, and contour farming are needed to reduce the hazard of water erosion. Close spaced high-residue crops provide adequate cover and residue. Crop residue should be left on the soil surface and tillage kept to a minimum to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth.

This soil has high potential for urban uses. Low strength, which affects roads and streets, and slope are limitations. These limitations can be easily overcome through proper design and careful installation.

The capability subclass is IVe, dryland, and IVe, irrigated. The range site is Sandy Loam.

8—Berda-Veal association, undulating. This association consists of deep, well drained soils on smooth low hills and ridges. The hills and ridges are separated by narrow, branching draws. Slopes are convex and range from 3 to 8 percent. Veal soils are on the ridge crests and upper side slopes. Berda soils are on the mid slopes and foot slopes. The mapped areas are irregular in shape and 50 to 600 acres.

About 50 percent of this map unit is Berda soils, 35 percent is Veal soils, and 15 percent is mainly Acuff, Bippus, and Potter soils. The soils could be mapped separately, but because use and management are similar, the detail of mapping is adequate for the predicted uses.

Typically, Berda soils have a brown, moderately alkaline loam surface layer about 8 inches thick. The subsoil, to a depth of 44 inches, is light brown, moderately alkaline clay loam that contains threads and films of calcium carbonate. The underlying material to 60 inches is brown, moderately alkaline clay loam.

The natural fertility of Berda soils is medium. Permeability is moderate, and the available water capacity is high. Surface runoff is medium, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate.

Typically, the surface layer of Veal soils is brown, moderately alkaline loam about 6 inches thick. The subsoil, from 6 to 17 inches, is light brown, moderately alkaline clay loam. From 17 to 65 inches, it is a pinkish gray, moderately alkaline clay loam that is about 50 percent calcium carbonate.

The natural fertility of Veal soils is low. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion on bare areas is severe. The susceptibility to soil blowing is moderate. Because of the high lime content, chlorosis is evident in some plants.

These soils are not suitable for cultivation because of the slope and the hazard of erosion. Also, Veal soils are droughty because of the high carbonate content.

All the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of mid and short grasses and scattered shrubs and forbs. Proper stocking and controlled grazing are needed.

The potential is high for most urban uses. Low strength, which affects roads and streets, and slopes are the main limitations, but these can be easily overcome by good design and construction.

The capability subclass is VIe. The range site is Loamy for Veal soils and Hardland Slopes for Berda soils.

9—Bippus clay loam, 0 to 2 percent slopes. This deep, well drained soil is in smooth, shallow valleys and on flood plains along streams. Areas are long and narrow and are parallel to the stream channels. Slopes are plane to concave with dominant gradients of about 1 percent. Areas range from 10 to more than 200 acres, and most are less than 50 acres. This soil is rarely flooded; however, it receives some runoff from higher adjoining sloping soils.

Typically, the surface layer is a very dark grayish brown, moderately alkaline clay loam about 25 inches thick. The subsoil, to 72 inches, is brown, moderately alkaline clay loam. From 72 to 80 inches it is yellowish red, moderately alkaline clay loam.

Under native range this soil is high in natural fertility. Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of water erosion is slight. The susceptibility to soil blowing is also slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Spur soils and a few small areas of Bippus fine sandy loam. Included soils make up less than 20 percent of any one mapped area.

Most areas of this soil are used as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and small amounts of perennial forbs. Proper stocking, controlled grazing, and brush control are needed.

A few small areas are used for crops, chiefly winter wheat, grain sorghum, and forage sorghum. Most of these areas are dryfarmed. The potential for cultivated crops is high. Slope, shape of the areas, and proximity to nonarable soils affect the use of this soil for crops. Management is needed to control erosion. Terracing and

contour farming are needed on sloping areas to help control water erosion. Diversions and grassed waterways are needed in some places. Crop residue left on the soil surface and minimum tillage help to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth.

This soil has low potential for urban uses. Flash floods are rare. This limitation can be overcome only by major flood control measures.

The capability subclass is IIe, dryland, and IIe, irrigated. The range site is Draw.

10—Burson-Knoco-Rock outcrop association, steep. This association consists of well drained to excessively drained soils and Rock outcrop that occur in a regular pattern. The landscape (fig. 7) is one of steep stony areas, canyon walls, and escarpments. Slopes are dominantly 30 to 70 percent.

Geologic erosion is evident in some places. In most areas the surface is littered with fragments and boulders of limestone and sandstone. The steep Burson soils are mainly on side slopes and foot slopes above sandstone outcrop. The steep Knoco soils are mostly on side slopes below Rock outcrop. Areas are long and narrow and range from 30 to more than 1,000 acres.

About 30 percent of this map unit is Burson soils; 30 percent is Knoco soils; 20 percent is Rock outcrop; and 20 percent is Berda soils, narrow flood plains of Clairemont and Yomont soils, and small barren areas. Areas are large and vary in composition. The detail of mapping is adequate, however, for the predicted uses of the soils.

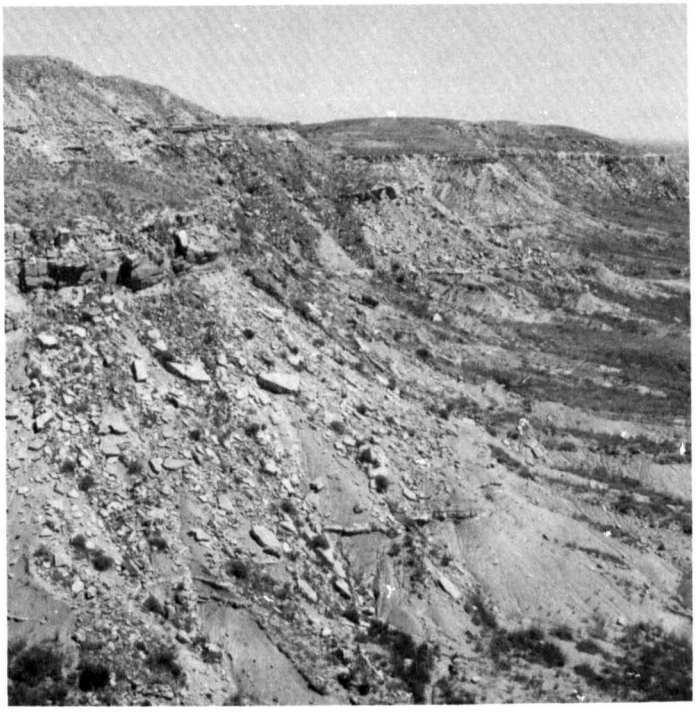


Figure 7.—Typical landscape of the Burson-Knoco-Rock outcrop association, steep.

Burson soils typically have a red, moderately alkaline loam surface layer about 6 inches thick. Below this to a depth of about 60 inches is red, very fine grained sandstone.

Natural fertility is low. Permeability is moderate, and the available water capacity is very low. Runoff is very rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. The root zone is restricted because the soil is shallow over rock.

The surface layer of the very shallow Knoco soils is typically a reddish brown, moderately alkaline clay about 4 inches thick. The underlying material to a depth of about 40 inches is reddish brown clayey shale.

Knoco soils have low natural fertility. Permeability is very slow, and the available water capacity is very low. Runoff is very rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is slight. The root zone is restricted because of the shallowness over shale.

This association is used as rangeland and wildlife habitat. It supports only sparse vegetation. The production potential for rangeland is low. Some areas are inaccessible to grazing by cattle but are accessible to deer and other wildlife. The climax plant community is a thin stand of short and mid grasses and scattered shrubs and trees.

This association is not suited to crops. It is poorly suited to urban uses. Slope, restricted root depth, and large stones are severe limitations that are very difficult to overcome.

The capability subclass is VIIs. The Burson soil is in the Rough Breaks range site. The Knoco soil is in the Shallow Clay range site. Rock outcrop is not assigned to a capability unit or range site.

11—Clairemont silty clay loam, occasionally flooded. This deep, well drained, nearly level soil is on narrow flood plains of small streams and large flood plains of the Canadian River. Flooding occurs about once every 3 to 5 years. The water quickly recedes and causes little damage to permanent vegetation. Slopes are dominantly less than 0.5 percent but range to 2 percent. Areas are long and narrow and are parallel to the stream channels. They range from 10 to 300 acres but are mainly less than 100 acres.

Typically, the surface layer is light reddish brown, moderately alkaline silty clay loam about 9 inches thick. The underlying material to a depth of about 80 inches is stratified reddish brown, brown, and reddish yellow, moderately alkaline silty clay loam.

Under native range this soil is medium in natural fertility. Permeability is moderate, and the available water capacity is high. Runoff is slow. The hazards of soil blowing and water erosion are slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Lincoln and Yomont soils and of soils that are similar to Clairemont soils but have a clayey texture throughout. These included soils make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. The production potential is high. The climax plant community is a mixture of mid and tall grasses and scattered shrubs and trees. Proper stocking and controlled grazing are effective management practices.

A few areas are used as cropland, both dryfarmed and irrigated. The main crops are grain sorghum and wheat. The potential for cultivated crops is high. Crop rotations, crop residue management, and timely and limited tillage reduce the hazard of soil blowing. If the soil is irrigated, a planned irrigation system, good water management, and fertilization are needed.

This soil is not suited to urban uses. Flooding is the main limitation and can be overcome only by major flood control measures.

The capability subclass is IIw, dryland, and IIw, irrigated. The range site is Loamy Bottomland.

12—Estacado clay loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on upland plains around playas and along the outer margins of the High Plains. Slopes are smooth and plane to slightly convex. Most areas are oval and range from 10 to 200 acres but average about 50 acres.

Typically, the surface layer is dark grayish brown, moderately alkaline clay loam about 10 inches thick. The subsoil to a depth of 60 inches is moderately alkaline clay loam that contains about 25 percent calcium carbonate. It is reddish brown in the upper 11 inches and yellowish red below.

Under native range this soil is high in natural fertility. The high lime content causes chlorosis, or yellowing of the leaves, in some plants. Permeability is moderate, and the available water capacity is medium. Runoff is slow, and the hazard of water erosion is slight. The susceptibility to soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some areas are small spots of Acuff, Olton, Pullman, and Posey soils. Also included are a few small areas of Estacado clay loam, 1 to 3 percent slopes. Included soils make up less than 15 percent of a mapped area.

Most of the acreage is used for crops. A few areas are irrigated. The main crops are winter wheat, grain sorghum, and corn. The potential is medium for cultivated crops. Crop residue and limited tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth. A planned irrigation system is needed to conserve water and reduce the risk of erosion. Fertilizer is also needed. Some crops respond to applications of trace elements.

Some areas are used as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered forbs. Proper stocking and controlled grazing are effective management practices.

The potential is medium for most urban uses. Low strength, which affects roads and streets, and the risk of corrosion are the main limitations. They can be overcome by good design and careful installation.

The capability subclass is IIIe, dryland, and IIe, irrigated. The range site is Loamy.

13—Estacado clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is mainly on the side slopes of playas and near the outer margins of the High Plains leading into the Canadian Breaks. Slopes are plane to convex. Areas are oblong bands that range from 10 to 400 acres in size but are commonly less than 150 acres.

Typically, the surface layer is brown, moderately alkaline clay loam about 8 inches thick. The subsoil is moderately alkaline clay loam to more than 62 inches. From 8 to 24 inches it is brown. From 24 to 32 inches it is reddish yellow. From 32 to 42 inches it is pink clay loam that is about 50 percent calcium carbonate. From 42 to 62 inches it is reddish yellow clay loam that is about 30 percent calcium carbonate.

Under native range this soil is high in natural fertility. Its high lime (carbonate) content causes chlorosis, or yellowing of the leaves, in some plants. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated.

Included in mapping are small areas of Acuff, Berda, Olton, Pullman, and Posey soils. Also included are a few small areas of Estacado clay loam, 3 to 5 percent slopes. The included soils make up less than 15 percent of a mapped area.

About half the acreage of this Estacado soil is cropland. Most of the acreage is dryfarmed. Some is irrigated. The chief crops are winter wheat and grain sorghum. The potential is medium for cropland use. Good management is needed to control soil blowing and water erosion. Crop residue and timely and limited tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth. Terraces, waterways, and contour farming dispose of excess rainfall. If this soil is to be irrigated, a properly designed irrigation system, good water management, and fertilization are needed. Some crops respond to additions of trace elements, such as iron.

Some areas are used as rangeland. In these areas the production potential for range is medium. The climax plant community is a mixture of short and mid grasses and small amounts of forbs. Proper stocking rates and controlled grazing are needed to prevent overgrazing and maintain productivity.

The potential is medium for urban uses. Low strength, which affects local roads and streets, and the risk of

corrosion are the main limitations. Good design and skillful installation can overcome these limitations.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Loamy.

14—Estacado clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on slopes around playas and along creeks and draws. Slopes are convex. The dominant gradient is about 4 percent. Areas are long ovals that range from 10 to 200 acres.

Typically, the surface layer is a dark brown, moderately alkaline clay loam about 10 inches thick. The subsoil extends to more than 60 inches. From 10 to 20 inches it is light brown, moderately alkaline clay loam. From 20 to 60 inches it is yellowish red, moderately alkaline clay loam that is about 15 percent calcium carbonate.

Under native range this soil is high in natural fertility. The lime content is high. Some plants exhibit chlorosis, or yellowing of the leaves, which results from deficiency of trace elements such as iron. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is moderate. Susceptibility to soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are a few areas of Estacado clay loam, 1 to 3 percent slopes; small areas of Acuff, Berda, Olton, Potter, and Posey soils; and a few eroded areas. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses along with a few forbs. Management concerns are proper stocking and controlled grazing.

A few small areas are used for crops, mainly winter wheat and grain sorghum. The soil is mainly dryfarmed, but a small acreage is irrigated. The potential is medium for cropland use. Slope and the hazard of water erosion are the main limitations. Management is needed to control water erosion and soil blowing. Crop residue left on the soil surface and minimum tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth. Terraces, waterways, and contour farming are needed to dispose of excess rainfall. If this soil is to be irrigated, a planned irrigation system, good water management, and fertilization are needed. Some crops respond to additions of trace elements such as iron.

The potential for most urban uses is medium. Low strength, which affects roads and streets, and the risk of corrosion are the main limitations. Both can be overcome by sound planning and construction.

The capability subclass is IVe, dryland, and IVe, irrigated. The range site is Loamy.

15—Gracemore soils, frequently flooded. This map unit is made up of somewhat poorly drained, nearly level soils on flood plains. These soils have a permanent water table and are flooded 2 to 3 times each year. The surface layer is of varying texture ranging from fine sand to clay loam. These soils are not uniform and do not occur in a regular pattern. Some areas are large enough to be mapped separately. The detail of mapping is adequate, however, for planning use and management of the soils. Areas are long and narrow and range from 10 to 100 acres in size.

Typically, Gracemore soils have a brown, moderately alkaline loam surface layer about 11 inches thick. The underlying material from 11 to 38 inches is brown fine sand and from 38 to 62 inches is light brownish gray loamy fine sand. The soils have thin strata of sandy loam and loam throughout.

Natural fertility is low. Surface runoff is slow. The soils are wet for long periods. A permanent water table is 1 to 3 feet below the soil surface. The hazards of water erosion and soil blowing are slight.

Included in some mapped areas and making up as much as 15 percent of the acreage are small areas of Lincoln soils and areas of soils that are saturated to the surface most of the time.

This unit is used entirely as rangeland. The production potential is high. The climax plant community is a mixture of mid and tall grasses and scattered trees and shrubs. Management is needed to avoid overgrazing. Proper stocking and controlled grazing are needed.

These soils are not suited to urban use or crops because of the hazard of flooding. Major flood control measures would be needed.

The capability subclass is Vw. The range site is Wet Bottomland.

16—Knoco-Badland association, rolling. This association consists of very shallow, well drained soils and Badland areas of barren outcrop of shaly and clayey red beds. The landscape is one of knolls, ridges, escarpments, gullied areas, and numerous small drainageways that carry the water swiftly into larger creeks. Knoco soils are on the knolls and ridges. Badland areas are on escarpments and in gullied areas, mostly below escarpments. Slopes are 5 percent to nearly vertical. Geologic erosion is active. Areas are irregular and range from 20 to 500 acres.

About 40 percent of this unit is Knoco clay, 40 percent is Badland, and 20 percent is other soils. Areas are commonly large and vary in composition. The detail of mapping is adequate, however, for the expected use of the soils.

Knoco soils typically have a thin, reddish brown, moderately alkaline clay surface layer about 6 inches thick. The underlying material to 50 inches is reddish brown clayey shale.

Natural fertility is very low. Permeability is very slow, and the available water capacity is very low. Runoff is rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. The root zone is restricted because of shallowness over shale.

Included in mapping are small areas of the closely similar Glenrio soils and Quay soils and areas of Clairemont soils on narrow flood plains. These soils make up as much as 20 percent of a mapped area.

All the acreage is rangeland. The climax plant community is a mixture of short and mid grasses. The plant cover is very sparse. The production potential is very low. Management concerns are proper stocking and controlled grazing.

This map unit is not suited to cropland use, and it has very low potential for urban use. Low strength, which affects local roads and streets, slope, shrink-swell potential, and clayey texture are limitations that are difficult to overcome.

The capability subclass is VIIs and the range site is Shallow Clay for Knoco soil. Badland is not assigned to a capability class or range site.

17—Latom-Rock outcrop complex, 3 to 15 percent slopes. This complex consists of very shallow, well drained, gently sloping to moderately steep soils and Rock outcrop that occur in a regular pattern. The landscape is one of convex ridges, moderately steep side slopes, and narrow drainageways. In some areas, boulders of sandstone are on the surface (fig. 8).

Latom soils are mainly on the upper parts of the ridges above Rock outcrop. The strongly sloping to moderately steep areas of Rock outcrop are on escarpments and severely eroded foot slopes. The mapped areas are long and narrow and range from 20 to 300 acres.

Figure 8.—Area of Latom-Rock outcrop complex, 3 to 15 percent slopes.

This complex is about 40 percent Latom soils and 30 percent Rock outcrop. The rest is small areas of Berda, Mobeetie, and Quay soils on uplands; a few areas of Bippus, Lincoln, and Yomont soils on narrow flood plains; and areas of a soil that is similar to the Latom soil but is underlain by weakly cemented sandstone. Areas of these soils are so small and intermingled that mapping them separately was not feasible.

Latom soils typically have a grayish brown, moderately alkaline fine sandy loam surface layer about 8 inches thick. Below this is strongly cemented sandstone that extends to a depth of more than 60 inches.

The natural fertility of Latom soils is low. The surface layer is moderately permeable, and the underlying layers are slowly permeable. Because these soils are very shallow, available water capacity is very low. Runoff is medium to rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. The root zone is restricted because of shallowness over rock.

This complex is used entirely as rangeland. The production potential is low. The climax plant community is a sparse mixture of mid and tall grasses and scattered shrubs and yucca. Good management includes proper stocking and controlled grazing.

This complex is not suitable for farming. The potential for urban uses is low. Slopes, large stones, and shallowness over rock are limitations that are difficult to overcome.

The Latom soil is in capability subclass VIIs and Very Shallow range site. Rock outcrop is not assigned to a capability class or range site.

18—Likes loamy fine sand, 1 to 8 percent slopes. This deep, excessively drained, undulating soil is on hills and ridges. Areas are oval in shape and range from 25 to 1,500 acres in size.

Typically, the surface layer is grayish brown, moderately alkaline loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches is brownish, moderately alkaline loamy fine sand that has a few pebbles of quartz and fine concretions of calcium carbonate.

Natural fertility is low. The available water capacity is low, and permeability is moderately rapid. Surface runoff is slow, and the hazard of water erosion is slight. Susceptibility to soil blowing is severe. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Lincoln, Mobeetie, Potter, Tascosa, Tivoli, and Veal soils. Also, local shifting of the soil by wind in some places causes nearly barren areas. The included soils make up less than 25 percent of some mapped areas.

All the acreage is rangeland. The climax plant community is a mixture of mid and tall grasses and scattered shrubs. The production potential is high. Proper stocking and controlled grazing are needed to maintain productivity.

This soil is not suited to use as cropland. The potential for urban use is low. The sandy texture and slope are the main limitations and can be overcome through sound planning and construction.

The capability subclass is VIe. The range site is Loamy Sand.

19—Lincoln soils, frequently flooded. This map unit is made up of somewhat excessively drained, nearly level soils on flood plains along major streams. These soils are subject to flooding about 2 or 3 times each year. The texture of the surface layer of Lincoln soils ranges from loam to fine sand.

This map unit is about 75 percent Lincoln soils and 25 percent Yomont and Gracemore soils. Areas are not uniform and do not occur in a regular pattern. Some areas are large enough to be mapped separately, but generally the soils are so intricately mixed that mapping them separately at the scale used is not practical.

Typically, Lincoln soils have a light brown, moderately alkaline loamy fine sand surface layer about 8 inches thick. The underlying material to a depth of 65 inches is stratified pink, moderately alkaline loamy fine sand.

The natural fertility is low. Surface runoff is slow, and the hazard of water erosion is slight. The susceptibility to soil blowing is severe. The root zone is deep and is easily penetrated. The permanent water table generally is at a depth of more than 6 feet, but a seasonal high water table is at a depth of 5 feet in a few places.

This map unit is used entirely as rangeland. The production potential is high. The climax plant community is a mixture of mid and tall grasses and scattered trees and shrubs. Careful management is needed to avoid overgrazing. Proper stocking and controlled grazing are needed to maintain productivity.

These soils are not suited to urban uses or cropland use because of the hazard of flooding. Major flood control measures would be needed to overcome this limitation.

The capability subclass is Vw. The range site is Sandy Bottomland.

20—Lipan clay. This deep, moderately well drained to somewhat poorly drained, nearly level soil is on playa benches. Slopes are plane to slightly concave. The dominant gradient is less than 0.5 percent. Following heavy or prolonged rainfall, some areas are inundated, or ponded, for brief periods. Areas are crescent shaped and partially encircle the playa basins. They are 20 to 125 acres.

Typically, this soil is calcareous, moderately alkaline clay to a depth of more than 80 inches. It is gray in the upper part and light gray in the lower part.

The natural fertility is medium. The soil is very slowly permeable. The available water capacity is high. Runoff is slow or is ponded. The hazard of water erosion is slight. Susceptibility to soil blowing is moderate.

Included in mapping are small spots of Lofton and Randall soils that make up less than 20 percent of some mapped areas.

Most areas are used as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses. Careful management is needed to avoid overgrazing. Effective measures are proper stocking and controlled grazing.

A few areas are used for grain sorghum and winter wheat. The potential is medium for cultivated crops. Periodic wetness is the main limitation. Managing crop residue on the soil surface helps to control soil blowing and maintain tilth. Grassed waterways and diversion terraces are needed in some places to carry off excess water.

The potential is very low for urban uses. Flooding, the main limitation, can be overcome only by costly flood control and drainage measures. The high shrink-swell potential and low strength, which affects roads and streets, can be overcome by good design and construction.

The capability subclass is IIIe. The range site is Lakebed.

21—Lofton clay loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on playa benches. Slopes are plane to slightly concave. Areas are generally crescent shaped and partially encircle the playa basin. They range from 25 to 150 acres.

Typically, the surface layer is dark gray, mildly alkaline clay loam about 10 inches thick. The subsoil is clay that extends to more than 80 inches. The upper part is dark grayish brown, mildly alkaline clay. The middle part is grayish brown, moderately alkaline clay. The lower part is grayish brown, moderately alkaline clay that has common threads and films of calcium carbonate.

The natural fertility is high. Permeability is very slow, and the available water capacity is high. Surface runoff is slow to very slow. Some areas remain wet for short periods following heavy or prolonged rainfall. The hazards of water erosion and soil blowing are slight.

Included in mapping are small areas of Lipan and Randall soils, which make up as much as 15 percent of some mapped areas.

This soil is used mainly for crops. Some areas are irrigated. The principal crops are grain sorghum and winter wheat. The potential is high for crops. Most areas receive some runoff from surrounding soils. Good management includes leaving large amounts of crop residue on the surface to conserve soil moisture, reduce blowing, and maintain tilth. If this soil is to be irrigated, a properly designed irrigation system, good water management, and fertilization are needed. In places, diversion terraces and grassed waterways are needed to handle excess runoff.

Some areas are used as rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses. The main concerns of management are proper stocking and controlled grazing.

The potential for urban use is low. Surface texture and shrink-swell potential are the main limitations and can be overcome through sound planning and construction.

The capability subclass is IIIe, dryland, and IIs, irrigated. The range site is Clay Loam.

22—Mobeetie fine sandy loam, 0 to 3 percent slopes. This deep, well drained, gently sloping soil is on hills and ridges. Slopes are smooth and convex. Areas are oval and range from 15 to 100 acres.

Typically, this soil is moderately alkaline fine sandy loam to 60 inches or more. The surface layer is brown, the subsoil is light brown, and the substratum is reddish brown.

This soil is low in natural fertility. Permeability is moderately rapid, and the available water capacity is medium. Runoff is medium, and the hazard of water erosion is moderate. The susceptibility to soil blowing is also moderate. The deep root zone is easily penetrated.

Included in some areas are small areas of Acuff, Amarillo, Berda, and Veal soils and small areas of Mobeetie fine sandy loam, 3 to 5 percent slopes. These included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland, for which the production potential is medium. It supports a climax plant community of short and mid grasses and scattered shrubs. Management needs are proper stocking and controlled grazing.

A few areas are used for wheat and grain sorghum. Terraces, grassed waterways, and contour farming are needed to control water erosion. Crop residue managed on the surface helps to conserve moisture, slow runoff, control soil blowing, and maintain tilth. Also needed is timely and limited tillage. The potential is medium for cropland use.

The potential is high for urban uses. There are no significant limitations to construction of dwellings, small commercial buildings, or streets.

The capability subclass is IIIe, dryland. The range site is Mixedland Slopes.

23—Mobeetie fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on the mid slopes and foot slopes of hills and ridges. Areas are long ovals 10 to 100 acres in size.

This soil is typically moderately alkaline fine sandy loam to a depth of 60 inches or more. The surface layer is brown and about 8 inches thick. The subsoil and underlying material are light brown.

This soil is low in natural fertility. Permeability is moderately rapid, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is moderate. Susceptibility to soil blowing is moderate.

Included in some mapped areas are areas of Amarillo, Berda, Potter, Posey, and Veal soils and areas of

Mobeetie fine sandy loam, 5 to 8 percent slopes. These inclusions make up less than 15 percent of any one mapped area.

Most of the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain production.

A few areas are used for wheat and grain sorghum. The potential is low for cropland use. Terraces, contour farming, and grassed waterways are needed to control water erosion. Crop residue left on the soil surface and minimum tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth.

There are no significant limitations for construction of dwellings, small commercial buildings, or streets. The potential is high for urban uses.

The capability subclass is IVe. The range site is Mixedland Slopes.

24—Mobeetie fine sandy loam, 5 to 12 percent slopes. This deep, well drained, sloping soil is on mid slopes and foot slopes below escarpments. Slopes are plane to convex. The dominant gradient is about 9 percent. These long, narrow areas are 20 to more than 1,000 acres.

Typically, this soil is moderately alkaline fine sandy loam to 60 inches or more. The surface layer and subsoil are brown. The underlying material is light brown.

The natural fertility is low. Permeability is moderately rapid, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is moderate. Susceptibility to soil blowing is moderate. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Likes, Potter, Tascosa, and Veal soils and a few small areas of Mobeetie fine sandy loam, 3 to 5 percent slopes. These included soils make up less than 15 percent of a mapped area.

All the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain production.

This soil is poorly suited to use as cropland but has high potential for urban uses. Proper planning, design, and construction can easily overcome the slope limitation.

The capability subclass is VIe. The range site is Mixedland Slopes.

25—Mobeetie-Tascosa association, rolling. This soil association is on smooth knolls, hills, and ridges that have rounded crests. These landforms are separated by narrow branching drainageways. Slopes are mainly convex. Gradients generally are 5 to 15 percent but range to 20 percent. Mobeetie soils are on the lower side slopes and foot slopes. The very gravelly Tascosa soils are on crests and upper sides of the knolls, hills, and ridges. Areas are oval and range from 50 to more than 1,000 acres.

This association is about 50 percent Mobeetie soils, 25 percent Tascosa soils, and 25 percent Amarillo, Bippus, and Quay soils. Areas are commonly large and vary in composition. The detail of mapping is adequate, however, for the expected use of the soils.

Mobeetie soils typically are calcareous, moderately alkaline fine sandy loam to a depth of 60 inches or more. The surface layer is grayish brown, the subsoil is pale brown, and the substratum is very pale brown.

The natural fertility of Mobeetie soils is low. Permeability is moderately rapid, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate in unprotected areas. The deep root zone is easily penetrated.

Typically, the surface layer of Tascosa soils is brown, moderately alkaline gravelly sandy loam about 9 inches thick. The subsoil is grayish brown, moderately alkaline very gravelly sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, moderately alkaline very gravelly loamy sand.

Tascosa soils have medium natural fertility in the surface layer. Permeability is moderate, and the available water capacity is medium. Surface runoff is rapid, and the hazard of water erosion is slight. The susceptibility to soil blowing is slight.

All the acreage is rangeland, for which the production potential is medium. Tascosa soils support a sparse climax plant community of short and mid grasses. Mobeetie soils have a good stand of short and mid grasses and scattered shrubs. Management is needed to prevent overgrazing. Effective practices are proper stocking and controlled grazing.

This association is not suited to use as cropland. Slopes and gravel are limitations.

The potential is low for urban uses. Slopes and gravel are limitations that are difficult to overcome.

Mobeetie soils are in capability subclass VIe and the Mixedland Slopes range site. Tascosa soils are in capability subclass VIs and the Gravelly range site.

26—Mobeetie-Veal association, undulating. This association consists of deep, well drained soils on smooth low hills and ridges that are separated by narrow, branching drainageways. Slopes are convex. Gradients are commonly 3 to 8 percent and range to 12 percent. Mobeetie soils are on the foot slopes and lower side slopes. Veal soils are on crests of ridges and the upper slopes. Areas are irregular and range from 50 to 600 acres.

This association is about 35 percent Mobeetie soils, 35 percent Veal soils, and 30 percent Amarillo, Berda, Bippus, Potter, and Posey soils. Areas are commonly

large and vary in composition. The detail of mapping is adequate, however, for the expected use of the soils.

Typically, Mobeetie soils are calcareous fine sandy loam to more than 60 inches. The surface layer, about 7 inches thick, is brown. The subsoil is light brown to 40 inches. The underlying layer is reddish yellow.

The natural fertility of Mobeetie soils is low. Permeability is moderately rapid, and the available water capacity is medium. Surface runoff is rapid, and the hazard of water erosion is severe. Susceptibility to soil blowing is moderate. Roots easily penetrate the deep root zone.

Veal soils typically have a grayish brown, moderately alkaline loam surface layer about 6 inches thick. The subsoil, from 6 to 36 inches, is pale brown, moderately alkaline clay loam that is about 45 percent calcium carbonate. From 36 to 60 inches it is reddish yellow, moderately alkaline clay loam.

Veal soils have low natural fertility. Permeability is moderate, and the available water capacity is medium. Surface runoff is rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate.

All the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of mid and short grasses and a few scattered shrubs. Proper stocking and controlled grazing are needed to prevent overgrazing.

This association is not suited to farming because of the slope. The potential is medium for urban uses. Slope, excess lime, and low strength, which affects roads and streets, are limitations but can be overcome through sound planning, design, and construction.

The capability subclass is VIe. The range site is Mixedland Slopes for Mobeetie soils and Loamy for Veal soils.

27—Montoya clay. This deep, nearly level, well drained soil is on terraces along major streams and in slight depressions on uplands. Slopes range from 0 to 2 percent but are mainly less than 1 percent. In most areas the surface is uneven because of a microrelief of slight depressions and low mounds. The soil is subject to shallow floods of very brief duration about once each 5 years. These floods cause little damage to permanent vegetation. Areas are oval to irregular in shape and range from 10 to 200 acres in size.

Typically, this soil is reddish brown, moderately alkaline clay to about 48 inches. The underlying material to 60 inches or more is reddish brown shaly clay.

The natural fertility is medium. Permeability is very slow. The available water capacity is high. Surface runoff is slow. Some depressed areas remain wet for short periods following rains. The hazard of water erosion is slight, and susceptibility to soil blowing is moderate.

Included in some mapped areas are small areas of Clairemont, Quay, and Yomont soils. These included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. The production potential is low. A mixture of short and mid grasses makes up the climax plant community. Galleta is the main grass. Management is needed to avoid overgrazing.

The potential is low for farming because of droughtiness. A few small areas are used for wheat and forage sorghum. Crop residue management and minimum tillage are needed to help conserve soil moisture and maintain tilth.

The soil is not suited to urban uses because of the flood hazard. Major flood control measures would be needed. The surface texture and shrink-swell potential are other limitations that can be overcome by good planning and construction.

The capability subclass is IVs. The range site is Clay Flat.

28—Olton clay loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is near playas on the High Plains and on broad, low divides on the margins of the High Plains. Slopes are smooth and slightly convex. The dominant gradient is about 0.5 percent. Areas are oval and range from 25 to 600 acres.

Typically, the surface layer is dark brown, mildly alkaline clay loam about 6 inches thick. The subsoil, from 6 to 52 inches, is moderately alkaline clay loam that is dark brown in the upper part, reddish brown in the middle part, and yellowish red in the lower part. From 52 to 65 inches it is pink, moderately alkaline clay loam that contains about 20 percent calcium carbonate.

The natural fertility is high. Permeability is moderately slow, and the available water capacity is high. Surface runoff is slow, and the hazard of water erosion is slight. The susceptibility to soil blowing is also slight. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Acuff, Amarillo, Estacado, and Pullman soils. Also included are a few small areas of Olton clay loam, 1 to 3 percent slopes. These included soils make up less than 10 percent of a mapped area.

This soil is used mainly as rangeland. The production potential is medium. The soil supports a climax plant community of short grasses and small amounts of mid grasses and forbs. The main grasses are blue grama and buffalograss. Proper stocking and controlled grazing are needed to prevent overgrazing.

A few areas are used for crops, mainly winter wheat, grain sorghum, and corn. In most of these areas the soil is dryfarmed. In a few it is irrigated. The potential is high for cultivated crops in irrigated areas. Adequate amounts of crop residue left on the surface and timely and limited tillage conserve moisture, control soil blowing, and preserve tilth. If this soil is to be irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The potential for urban uses is medium. Low strength, which affects roads and streets, the clayey subsoil, and shrink-swell potential are the main limitations. These

limitations can be overcome by sound planning and design and careful construction.

The capability subclass is IIIe, dryland, and IIe, irrigated. The range site is Clay Loam.

29—Olton clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is in broad areas leading into playas and on ridges on the margins of the High Plains. Slopes are plane to concave. The dominant gradient is about 2 percent. Areas are long ovals and range from 20 to 500 acres.

Typically, the surface layer is dark brown, mildly alkaline clay loam about 10 inches thick. The subsoil is more than 80 inches thick. The upper 22 inches is brown, moderately alkaline clay loam. The next 28 inches is yellowish red, moderately alkaline clay loam that contains about 20 percent calcium carbonate. The lower 20 inches is reddish yellow, moderately alkaline clay loam.

The natural fertility is high. Permeability is moderately slow, and the available water capacity is high. Surface runoff is medium, and the hazard of water erosion is moderate. The susceptibility to soil blowing is slight. Roots easily penetrate the deep root zone.

Included in a few mapped areas are a few small areas of Acuff, Amarillo, Estacado, and Pullman soils. Also included are a few areas of Olton clay loam, 0 to 1 percent slopes. These included soils make up less than 15 percent of any one mapped area.

Most of this soil is used as rangeland. The production potential is medium. In most areas the climax plant community is a dense cover of short grasses, mainly blue grama and buffalograss, and a modest amount of mid grasses and forbs. Proper stocking and controlled grazing to prevent overuse are needed.

Some areas are used for winter wheat, grain sorghum, and corn. Only a small acreage is irrigated. The potential is high for cropland use in irrigated areas. Terraces, waterways, and contour farming are needed to reduce the hazard of water erosion. Crop residue left on the surface and minimum tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth. If this soil is to be irrigated, a planned irrigation system, good water management, and fertilization are needed.

The potential is medium for urban uses. Low strength, which affects roads and streets, shrink-swell potential, and the clayey texture are limiting factors but can be overcome through sound planning, design, and construction.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Clay Loam.

30—Posey clay loam, 0 to 3 percent slopes. This deep, well drained, gently sloping soil is on ridges of uplands and on slopes around playas and along draws. Slopes are convex with dominant gradients of about 2 percent. Areas are mostly oblong and range from 10 to 100 acres in size.

Typically, the surface layer is brown, moderately alkaline clay loam about 6 inches thick. The subsoil, from 6 to about 18 inches, is reddish yellow, moderately alkaline clay loam. From 18 to 65 inches it is yellowish red, moderately alkaline clay loam that is about 20 percent calcium carbonate.

The natural fertility is medium. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is moderate. Susceptibility to soil blowing is also moderate. Because of the high lime content, some plants exhibit chlorosis, or yellowing of the leaves. The deep root zone is easily penetrated.

Included in some mapped areas are small areas of Acuff, Estacado, and Potter soils. Also included are small areas of Posey clay loam, 3 to 5 percent slopes. The included soils make up less than 20 percent of some mapped areas.

This soil is used mainly as rangeland. The production potential is medium. The climax plant community consists mainly of mid and short grasses and a few scattered shrubs and forbs. For maintaining productivity, proper stocking and controlled grazing are effective practices.

A few areas are used for winter wheat. A few irrigated areas are used for grain sorghum and corn. The potential is medium for cropland use. Management is needed to control water erosion and soil blowing. Effective practices to protect the soil are growing high-residue crops, managing crop residue, and use of minimum tillage along with contour farming and terracing. Stubble mulching is the best form of residue management. If this soil is irrigated, a well planned irrigation system, water management, and fertilization are needed. Some crops respond to applications of trace elements such as iron.

The potential is medium for most urban uses. Excess lime, which affects growing plants, the risk of corrosion, and the clayey surface texture are the only limitations.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Loamy.

31—Posey clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is along creeks and draws. Slopes are smooth and convex. The dominant gradient is about 4 percent. Areas are long and narrow and range from 15 to 200 acres.

Typically, the surface layer is brown, moderately alkaline clay loam about 5 inches thick. The subsoil, from 5 to 15 inches, is light brown, moderately alkaline clay loam. From 20 to 60 inches or more it is brown, moderately alkaline clay loam that is 20 to 30 percent calcium carbonate.

This soil is medium in natural fertility. Permeability is moderate, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. Some plants exhibit deficiencies of trace

elements, such as iron, because of the large amounts of carbonates. The root zone is deep and is easily penetrated.

Included with this soil in mapping are a few small areas of Bippus, Berda, Estacado, and Potter soils. These included soils make up less than 15 percent of any one mapped area.

Most of this soil is used as rangeland; the production potential is medium. The climax plant community is a mixture of mid and short grasses along with scattered shrubs and forbs. Proper stocking and controlled grazing are needed to maintain productivity.

A few areas are used for crops, mainly winter wheat, which is grazed by livestock in winter and harvested for grain in spring. The potential for crops is low because of slope and the hazard of water erosion. Terraces, contour farming, and management of crop residue are needed to control water erosion and soil blowing. A close spaced crop that produces a large amount of residue should be grown continuously in irrigated areas.

The potential for urban use is medium. The main limitations, excess lime, risk of corrosion, and the clayey surface texture, are easily offset by good planning.

The capability subclass is IVe, dryland, and IVe, irrigated. The range site is Loamy.

32—Potter gravelly loam, 3 to 12 percent slopes. This map unit is made up of very shallow, well drained, gently sloping to strongly sloping gravelly soils on low hills and ridges. Slopes are convex. Areas are oblong to long and range from 20 to 300 acres.

Typically, the surface layer is grayish brown, moderately alkaline gravelly loam about 8 inches thick. The underlying material to a depth of 30 inches is a mixture of hard and soft white caliche.

The natural fertility is low. Permeability is moderate in the surface layer and variable in the underlying material. The available water capacity is very low. Runoff is rapid, and the hazard of water erosion is severe in unprotected areas. The root zone is restricted because of the shallowness over caliche.

Small areas of Mobeetie, Posey, and Veal soils and a few areas of moderately steep Potter soils are included in mapping. The included soils make up as much as 20 percent of some mapped areas.

All the acreage is rangeland. The production potential is low. The climax plant community consists of a thin cover of mid and short grasses and scattered shrubs. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain productivity.

This soil is not suited to cropland use and has very low potential for urban uses. Slope, shallowness over rock, and small stones, or gravel, are limitations that are difficult to overcome. Some areas are good sources of caliche for use as road base material.

The capability subclass is VIIs. The range site is Very Shallow.

33—Potter-Mobeetie association, steep. This association consists of well drained, strongly sloping to steep soils on and along escarpments along the outer margins of the High Plains and on rounded hills and ridges in the Canadian Breaks. Slopes are mostly plane to concave and range from 8 to 40 percent but are commonly about 25 percent. Potter soils are mainly on crests of hills and ridges and on and along the escarpments. Mobeetie soils are mainly on the lower foot slopes. Areas are long and narrow and range from 50 to 500 acres.

About 45 percent is Potter soils and about 30 percent Mobeetie soils. The rest is Berda, Bippus, Quay, Posey, and Veal soils and some outcrops of caliche. The composition of this unit is variable. The detail of mapping is adequate, however, for the expected use of the soils.

Typically, the surface layer of Potter soils is a pinkish gray gravelly loam about 7 inches thick. The underlying material to a depth of 60 inches is a mixture of hard and soft pink caliche.

The natural fertility of Potter soils is low. Permeability is moderate in the surface layer and variable in the underlying material. The available water capacity is very low. In unprotected areas runoff is rapid and the hazard of water erosion is severe. The root zone is restricted because of the shallowness over caliche.

Typically, the Mobeetie soils are a moderately alkaline fine sandy loam to more than 60 inches. The surface layer is brown, the subsoil is light brown, and the underlying material is pink.

Mobeetie soils have medium natural fertility. Permeability is moderately rapid, and the available water capacity is medium. Runoff is rapid, and the hazard of water erosion is severe. The susceptibility to soil blowing is moderate. The soil has a deep root zone that is easily penetrated.

All the acreage is used as rangeland or wildlife habitat. The production potential for rangeland is low. Potter soils support a climax plant community consisting of a thin cover of mid and short grasses and scattered shrubs. Mobeetie soils support a climax plant community of mid and short grasses and scattered shrubs and a few tall grasses. Proper stocking and controlled grazing are needed to prevent overgrazing and maintain productivity.

This association is not suited to use as cropland and has very low potential for urban uses. Slope, shallowness over rock, and small stones or gravel are limitations that are difficult to overcome.

The capability subclass is VIIs. The range site is Very Shallow for Potter soils and Mixedland Slopes for Mobeetie soils.

34—Pullman clay loam, 0 to 1 percent slopes. This deep, well drained soil is on the broad smooth featureless High Plains. Most of this soil is in one large continuous area of several thousand acres that is dotted with playas. Slopes are plane to slightly convex. Gradients are remarkably uniform and mainly 0.2 to 0.5 percent.

Typically, the surface layer is brown, mildly alkaline clay loam about 5 inches thick. The subsoil, from 5 to 40 inches, is moderately alkaline clay that is dark brown in the upper part and brown in the lower part. From 40 to 55 inches it is yellowish red, moderately alkaline clay loam. From 55 to 80 inches or more it is pink or reddish yellow, moderately alkaline clay loam that contains about 50 percent calcium carbonate.

The natural fertility is high. Permeability is very slow, and the available water capacity is medium. Surface runoff is slow, and the hazard of water erosion is slight. The susceptibility to soil blowing is also slight. The deep root zone can be easily penetrated.

Included with this soil in mapping are a few small areas of Acuff, Estacado, Olton, Randall, and Posey soils. Also included are a few small areas of Pullman clay loam, 1 to 3 percent slopes. These included soils make up less than 10 percent of any one mapped area.

Most of the acreage is cropland, and some is irrigated. The potential is high for cropland use. This Pullman soil is the most extensive cropland soil in the county. The chief crops are winter wheat and grain sorghum. Managing crop residue on the surface and minimum tillage help to conserve moisture, control soil blowing, and maintain tilth. If the soil is irrigated, a planned irrigation system, good water management, and fertilization are needed.

Some areas are used as rangeland. The production potential is medium. The climax plant community consists mainly of short grasses, such as blue grama and buffalograss, and thin stands of mid grasses and forbs. Proper stocking and controlled grazing help maintain productivity and prevent overgrazing.

The potential is medium for urban uses. Low strength, which affects local roads and streets, shrink-swell potential, and the risk of corrosion are the main limitations. Sound planning and adequate design along with careful construction are needed.

The capability subclass is IIIe, dryland, and IIs, irrigated. The range site is Clay Loam.

35—Pullman clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is around playas and along draws on the High Plains. Slopes are smooth and slightly convex. Areas are long and narrow and range from 10 to 350 acres.

Typically, the surface layer is brown, mildly alkaline clay loam about 8 inches thick. The subsoil, from 8 to 24 inches, is dark brown, moderately alkaline clay. From 24 to 38 inches it is reddish brown, moderately alkaline clay. From 38 to 62 inches it is pink and yellowish red, moderately alkaline clay loam that is about 50 percent calcium carbonate.

This soil is high in natural fertility. Permeability is very slow, and the available water capacity is medium. Surface runoff is medium, and the hazard of water erosion is moderate. The soil is slightly susceptible to soil blowing. The root zone is deep and can be easily penetrated.

Included in some mapped areas are a few small areas of Acuff, Estacado, Olton, Randall, and Posey soils. These included soils make up less than 10 percent of a mapped area.

This soil is mainly used for wheat and grain sorghum. A few areas are irrigated. The potential is high for use as cropland. Good management is needed to control water erosion and conserve soil moisture. Adequate crop residue on the surface and minimum tillage are effective practices. Terraces, waterways, and contour farming are needed to control runoff. If this soil is to be irrigated, a well designed irrigation system and good water management are needed. Most crops respond to applications of fertilizer.

Some areas are used as rangeland. The production potential is medium. The climax plant community is mainly a short grass prairie and small amounts of mid grasses and forbs.

The potential is medium for most urban uses. Low strength, which affects roads and streets, shrink-swell potential, and the risk of corrosion are the main limitations. Sound planning, good design, and careful construction are needed.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Clay Loam.

36—Quay silty clay loam, 0 to 5 percent slopes. This deep, well drained, gently sloping soil is on divides, ridges, and foot slopes below escarpments. Slopes are smooth and convex. The dominant gradient is 2 to 4 percent. Areas range from large ovals to narrow bands along drains.

This soil typically has a reddish brown, moderately alkaline, calcareous silty clay loam surface layer about 8 inches thick. The subsoil, to 36 inches or more, is moderately alkaline, calcareous silty clay loam that is reddish brown in the upper few inches and light reddish brown below. The lower part has few to common films, threads, and soft masses of calcium carbonate. The underlying material to 66 inches is light reddish brown, calcareous silty clay loam.

The soil is medium in natural fertility. It is moderately permeable and has high available water capacity. Surface runoff is medium, and the hazard of water erosion is moderate. Susceptibility to soil blowing is also moderate. The root zone is easily penetrated.

Included in some mapped areas and making up less than 15 percent of the acreage are small areas of Berda, Glenrio, Montoya, and Veal soils.

Most of this soil is rangeland. The production potential is medium. The climax plant community consists mainly of short grasses and a few scattered mid grasses and forbs. The objective of management is to maintain productivity. Proper stocking and controlled grazing are needed.

A few small areas are used for winter wheat. The potential for cropland use is low. Slope and the hazard of water erosion are limitations in the more sloping

areas. Careful management is needed to control water erosion and soil blowing. Terraces, waterways, and contour farming are needed to control excess runoff. Managing crop residue on the surface and timely and limited tillage help to conserve moisture, slow runoff, control soil blowing, and maintain tilth.

The potential is medium for most urban uses. The main limitations are the risk of corrosion and low strength, which affects roads and streets. These limitations can be overcome by sound planning and design and careful construction.

The capability subclass is IVe, dryland, and IVe, irrigated. The range site is Clay Loam.

37—Quay-Glenrio-Burson association, rolling. This association consists of deep, shallow and very shallow, well drained to excessively drained soils on narrow ridges and slopes along creeks (fig. 9). Some areas are on knolls and ridges 10 to 60 feet high interspersed with smooth vales and draws. Slopes are mainly 5 to 10 percent but range up to 15 percent. Burson soils are on the crests of knolls, hills, and ridges and in the lower gullied areas caused by geologic erosion. Glenrio soils are mainly on the upper and mid slopes, but Quay soils are on the lower slopes and in smooth vales. Areas are irregular in shape and range from 50 to 1,000 acres.

About 40 percent of this association is Quay soils, 20 percent is Glenrio soils, and 15 percent is Burson soils. The rest is mainly small areas of Berda, Clairemont, Knoco, and Tascosa soils and sandstone and shale outcrops. Areas commonly are large and vary in

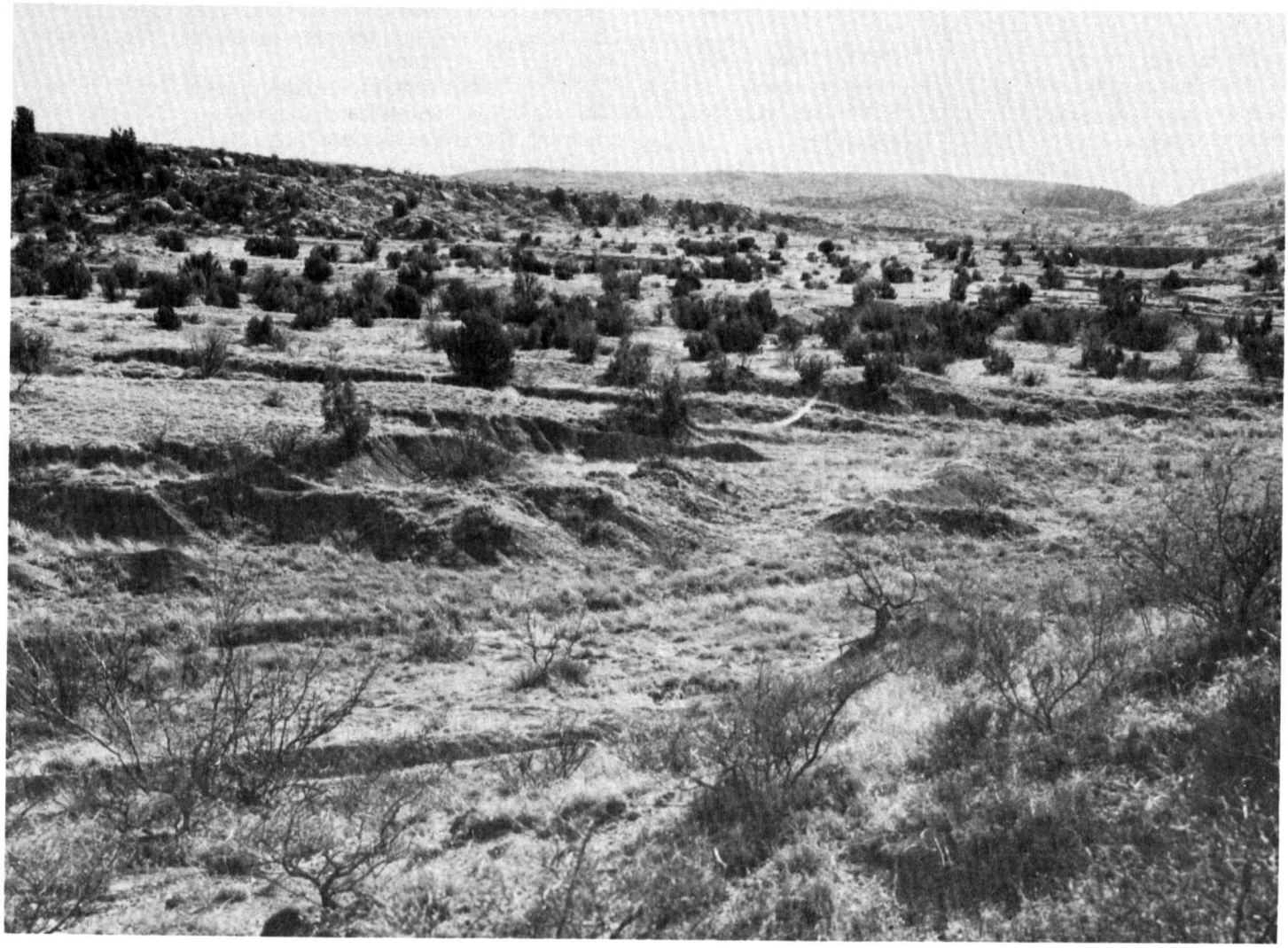


Figure 9.—Area of Quay-Glenrio-Burson association, rolling.

composition. The detail of mapping is adequate, however, for planning use and management of the soils.

Quay soils typically have a reddish brown, moderately alkaline silty clay loam surface layer about 9 inches thick. The subsoil, to a depth of 38 inches, is reddish brown, moderately alkaline silty clay loam that contains a few threads and films of calcium carbonate. The underlying material to 70 inches is reddish brown, calcareous silty clay loam.

The natural fertility of Quay soils is medium. Permeability is moderate, and the available water capacity is high. Runoff is rapid, and the hazard of water erosion is severe. The soil is moderately susceptible to soil blowing. The root zone is easily penetrated.

Glenrio soils have a reddish brown, moderately alkaline clay surface layer about 5 inches thick. The subsoil, to a depth of about 16 inches, is reddish brown, moderately alkaline clay that contains a few threads and films of calcium carbonate. The underlying material to a depth of 60 inches is variegated layers of reddish brown and light brownish gray clayey shale.

The natural fertility of Glenrio soils is low. Permeability is very slow, and the available water capacity is low. Surface runoff is medium to rapid, and the hazard of water erosion is severe. The soil is moderately susceptible to soil blowing. The root zone is restricted because of the clayey texture and shallowness over shale.

Burson soils have a thin, weak red, moderately alkaline loam surface layer about 7 inches thick. The underlying material to 50 inches is weak red, very fine grained sandstone.

Burson soils are low in natural fertility. Permeability is moderate, and the available water capacity is very low. Surface runoff is medium to very rapid. The hazard of water erosion is severe. Susceptibility to soil blowing is moderate. The root zone is restricted because of the shallowness over sandstone.

This association is not suited to use as cropland because of shallowness, the slope, and the hazard of water erosion.

All the acreage is rangeland. The production potential is low. Quay soils support a plant community of short grasses and a few mid grasses and forbs. Glenrio and Burson soils have a thin cover of short grasses and a few scattered shrubs. Grazing management is needed.

The potential for urban uses is low. Slope, shrink-swell potential, clayey texture, and the shale and sandstone layers are limitations that are difficult to overcome.

The capability subclass is VIIs. The range site is Clay Loam for Quay soils, Shallow Clay for Glenrio soils, and Rough Breaks for Burson soils.

38—Randall clay. This deep, somewhat poorly drained soil is on the bottoms of saucer-shaped playas. Most areas are oval and have smooth boundaries. Areas generally range from 5 to more than 100 acres, but a few are larger. Slopes are plane to concave and are commonly less than 0.3 percent. Areas of this soil receive runoff from adjoining areas. Most areas are wet for several weeks each year, and some are flooded for longer periods.

Typically, the surface layer is a dark gray, moderately alkaline clay about 20 inches thick. The next layer to 66 inches or more is grayish, moderately alkaline clay that contains a few concretions of calcium carbonate.

The natural fertility is high. The soil is very slowly permeable. The available water capacity is high, but the soil is droughty. The susceptibility to soil blowing is moderate in dry, unprotected areas.

Included at the outer edge of some mapped areas are a few small areas of Lipan and Lofton soils, which make up less than 10 percent of any one mapped area.

All the acreage is rangeland or wildlife habitat. The production potential for grazing forage is low to high, depending on the length and time of past flooding. The climax plant community is mainly a mixture of short grasses, mid grasses, sedges, smartweed, and ragweed. Controlled grazing and proper stocking are effective in preventing overgrazing.

This soil is not suited to cropland use or urban uses because of the flood hazard and high shrink-swell potential. Major drainage and flood control measures would be needed.

The capability subclass is VIw. The range site is Lakebed.

39—Springer loamy fine sand, 0 to 3 percent slopes. This deep, well drained, gently sloping soil is on broad divides and upland plains. Slopes are mainly convex. The dominant gradient is about 2 percent. Most areas are oval and range from 25 to 400 acres.

Typically, the surface layer is a light brown loamy fine sand about 10 inches thick. The subsoil, from 10 to 28 inches, is yellowish red fine sandy loam. From 28 to 49 inches it is light reddish brown loamy fine sand. From 49 to 80 inches it is yellowish red fine sandy loam. The soil is typically mildly alkaline to about 65 inches and moderately alkaline below.

Natural fertility under native range is low. Permeability is moderately rapid, and the available water capacity is medium. Runoff is slow. In unprotected areas, the hazard of water erosion is moderate and susceptibility to soil blowing is severe. The root zone is deep and is easily penetrated.

Included in some mapped areas are small areas of Amarillo, Likes, Mobeetie, and Tivoli soils. Also included are a few areas of Springer fine sandy loam and of Springer loamy fine sand that have slopes of 3 to 5 percent. Included soils make up less than 15 percent of any one mapped area.

All the acreage is rangeland (fig. 10). The production potential is medium. The areas support a climax plant community of mid and short grasses along with a few scattered shrubs.

This soil is not used for cultivated crops, but the potential is medium for winter wheat, grain sorghum, and forage sorghum. If this soil is cultivated, good management is needed to reduce the hazards of water erosion and soil blowing. Crop residue left on the surface and minimum tillage help to conserve moisture, slow runoff, reduce soil blowing, and maintain tilth.

This soil has high potential for urban uses. The only limitation is low strength, which affects roads and streets, and can be easily overcome by good planning, sound design, and careful installation.

The capability subclass is IIIe, dryland, and IIIe, irrigated. The range site is Loamy Sand.

40—Spur and Bippus soils, frequently flooded. This map unit consists of deep, well drained, nearly level soils on narrow flood plains that are 200 to 700 feet wide. Slopes range from 0 to 2 percent. The soils are subject to flooding 2 or 3 times each year; however, the water quickly recedes and causes little damage to permanent vegetation. Bippus and Spur soils are closely associated. In most places Spur soils are near stream channels, and Bippus soils are on low terraces along the outer margin of the flood plains.

This map unit is about 45 percent Spur soils, 25 percent Bippus soils, and 30 percent the scoured stream channel and other soils. Areas of these soils are variable and do not occur in a regular pattern. In most places the soils are so intermingled that mapping them separately at the scale used is not practical.

The surface layer of Spur soils is dark brown, moderately alkaline clay loam about 18 inches thick. The subsoil, to a depth of 30 inches, is brown, moderately alkaline clay loam. Below this to 60 inches is stratified, reddish brown, moderately alkaline clay loam.

The natural fertility of Spur soils is high. Permeability is moderate, and the available water capacity is high. Runoff is slow, and the erosion hazard is slight. The susceptibility to soil blowing is slight. The root zone is deep and is easily penetrated.

Typically, Bippus soils have a dark grayish brown clay loam surface layer about 18 inches thick. The subsoil, to a depth of about 50 inches, is brown clay loam. To about 62 inches it is light brown sandy clay loam. The underlying material from 62 to about 80 inches is light brown fine sandy loam. The soil is typically calcareous and moderately alkaline throughout.

Bippus soils have high natural fertility. Permeability is moderate, and the available water capacity is high.

Figure 10.—Area of Springer loamy fine sand, 0 to 3 percent slopes. This soil is in the Loamy Sand range site.

Runoff is slow, and the hazard of water erosion is slight. Susceptibility to soil blowing is also slight. The root zone is deep and is easily penetrated.

All the acreage is rangeland. The production potential is medium. The climax plant community is a mixture of short and mid grasses and scattered perennial forbs. Good management includes proper stocking and controlled grazing.

These soils are not suited to cropland use or urban uses because of the flood hazard. This limitation can be overcome only with major flood control measures.

The capability subclass is Vw. The range site is Draw.

41—Tascosa very gravelly loam, hilly. This soil is on knolls, hills, and ridges that have rounded crests and sloping to steep side slopes. A branching stream pattern lies between the hills and ridges and carries runoff. Slopes are convex and dominantly 10 to 30 percent but range from 5 to 40 percent. Areas are 20 to 500 acres.

Tascosa soils typically have a surface layer of dark grayish brown, moderately alkaline very gravelly loam about 8 inches thick. The subsoil, to a depth of 16 inches, is grayish brown, moderately alkaline very gravelly loam. The underlying material to about 60 inches is very pale brown, moderately alkaline very gravelly sandy loam.

The surface layer of Tascosa soils has medium natural fertility. Permeability is moderate, and the available water capacity is low. Surface runoff is rapid, but the hazard of water erosion is slight because of the large amount of gravel in the surface layer. Susceptibility to soil blowing is also slight.

Included in some mapped areas are small areas of Latom, Mobeetie, Quay, and Veal soils. These included soils are less than 20 percent of any one mapped area.

All the acreage is rangeland. The production potential is medium. The climax plant community consists mainly of a mixture of mid, tall, and short grasses and a few scattered shrubs. Proper stocking and controlled grazing are needed.

This soil is not suited to farming and has low potential for urban uses. Slopes and small stones or gravel are limitations that are difficult to overcome. The gravel is mined from some areas of Tascosa soils for use in the construction industry.

The capability subclass is VIs. The range site is Gravelly.

42—Tivoli fine sand. This deep, excessively drained, gently sloping to strongly sloping soil is on hummocks and dunes that are 3 to 30 feet high and that have side slopes of 3 to 12 percent. Areas are oval and range from 50 to 600 acres.

Typically, the surface layer is brown, neutral fine sand about 8 inches thick. The underlying material to a depth of 60 inches is reddish yellow, mildly alkaline fine sand.

This soil is low in natural fertility. Permeability is rapid, and the available water capacity is very low. Surface runoff is very slow. The hazard of water erosion is slight, but the susceptibility to soil blowing is severe.

Included with this soil in mapping are small areas of Amarillo, Likes, Mobeetie, Springer, and Veal soils. Also included are a few small areas of active dunes and blownout spots. These areas range mostly from 1 to 6 acres and make up less than 15 percent of any one mapped area.

This soil is not suited to use as cropland and is used entirely as rangeland. The potial for range is medium. The climax plant community is a mixture of tall and mid grasses and scattered shrubs and trees. Good management is needed to prevent overgrazing and subsequent soil blowing and can be accomplished by proper stocking and controlled grazing. With heavy grazing the vegetation deteriorates readily to annual weeds and grasses of low grazing quality.

The potential is low for most urban uses. Slope and the sandy texture are the main limitations and can be easily overcome by good planning, design, and installation.

The capability subclass is VIIe. The range site is Sandhills.

43—Yomont very fine sandy loam, occasionally flooded. This map unit consists of deep, well drained, nearly level soils on flood plains along major streams. Flooding occurs about every 2 to 5 years. The floods are very brief, and the overflow is shallow. Thus, there is little damage to areas in permanent vegetation. The surface is uneven. In a few places it has been cut by channels, some of which have been partially filled with alluvial sediments. Areas are oblong to irregular in shape and range from 10 to 100 acres.

Typically, the surface layer is reddish brown, moderately alkaline very fine sandy loam about 10 inches thick. The underlying material, from 10 to 37 inches, is reddish brown, moderately alkaline very fine sandy loam. From 37 to 60 inches it is stratified reddish brown, moderately alkaline silty clay loam.

The natural fertility is medium. Permeability is moderately rapid, and the available water capacity is high. Surface runoff is slow, and the hazard of water erosion is slight. Susceptibility to soil blowing is moderate. The deep root zone is easily penetrated.

Included in some mapped areas are small areas of Clairemont and Lincoln soils. These included soils make up less than 15 percent of any one mapped area.

All of this unit is rangeland (fig. 11). The production potential is high. The climax plant community consists of mid and tall grasses and a few scattered shrubs. Management needed to maintain productivity includes proper stocking and controlled grazing.

This soil is not suited to cropland use or urban uses because of the flood hazard.

The capability subclass is Vw. The range site is Loamy Bottomland.

Figure 11.—Landscape of Yomont very fine sandy loam, occasionally flooded.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops

Richard Heizer, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops, wheat, grain sorghum, and corn, are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 119,000 acres in the survey area was used for crops and pasture in 1970, according to the Conservation Needs Inventory (*5*). Of this total, 30,000 acres was irrigated grain sorghum and winter wheat, and 70,000 acres was mainly dryland wheat and some grain sorghum.

The acreage in crops has remained about constant. The irrigated acreage, however, is slowly declining because the water table in the Ogallala Formation is lowered as the irrigation water is continually pumped from the aquifer. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map units."

The soils in Oldham County have good potential for increased production of food and feed grains. Crop production on nonirrigated and irrigated land could be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

In planning effective management, a farmer must know what conservation practices are suited to the soil and the climate, how much the soil will produce, and what the limitations are.

Climate is the factor that most affects the farming in Oldham County. Crops suited to the soils are limited by low, variable annual rainfall and a fairly short growing season. Windstorms, occasional rains of high intensity, hail, blowing snow, and long severe droughts are hazards that must be considered in management. The chief purposes of management are to protect the soils against soil blowing and water erosion, conserve moisture, improve the physical condition of the soil, and maintain productivity.

erosion

Soil erosion caused by runoff is a major problem on all cultivated soils where slopes are more than 1 percent. As the length and gradient of slope increase, the hazard of water erosion increases.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Pullman soils. It is also damaging on soils that have a large accumulation of calcium carbonate in the upper part of the subsoil, for example, Estacado soils. Erosion reduces productivity on soils that tend to be droughty, such as Lipan and Lofton soils. Second, soil erosion on farmland results in sedimentation of streams and reservoirs. Control of erosion minimizes the pollution of streams and lakes by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control provides a protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soil.

Winter wheat and grain sorghum are the crops best suited to the climate of the county. A wheat-sorghum-fallow rotation, which is commonly used, tends to provide the most crop residue for cover and makes the best use of soil moisture. Essentially the same cropping system can be used in irrigated or dryfarmed areas. A better soil improvement program, however, can be carried out under irrigation. Commercial fertilizer can be added, more crops can be grown for green manure, more crop residue can be produced, and better use can be made of the residue. Ample moisture makes it practical to add commercial fertilizer. A rotation of wheat and grain sorghum is commonly used in irrigated areas.

Moisture, not fertility, is the factor that limits crop yields on the soils of Oldham County. About two-thirds of the total precipitation is lost through evaporation. Moisture conservation is needed to obtain dependable crop production on all arable soils in the county. Minimum tillage and cropping systems that provide substantial plant cover are needed to reduce erosion and conserve moisture (fig. 12). Minimum tillage keeps most of the crop residue on the surface. The term refers to only the tillage that is essential to crop production.

Terraces, diversions, and contour farming shorten the length of slope and reduce runoff and the risk of erosion. They are most practical on deep, well drained soils that have smooth slopes of 1 to 5 percent. On the nearly level Acuff, Olton, and Pullman soils, terracing and contour farming are used mainly to conserve moisture. All terraces require suitable outlets to dispose of excess water. If natural grassed drainageways are not available as outlets, grassed waterways should be constructed before terraces are built.

Excessive tillage tends to break down the structure of the soil. It produces a powdery surface layer that is highly susceptible to blowing, does not absorb water readily, and tends to crust following rains. Minimizing tillage and leaving crop residue on the surface increase infiltration, reduce evaporation of soil moisture, and slow runoff. These practices can be adapted to Acuff, Estacado, Lofton, Olton, and Pullman soils. They are more difficult to practice successfully, however, on soils that have a clayey surface layer, such as Lipan soils.

Soil blowing is a hazard on the loamy Amarillo and Mobeetie soils, the calcareous Estacado and Posey soils, and the sandy Likes, Springer, and Tivoli soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, surface mulch, or rough surface through proper tillage minimizes the hazard of soil blowing.

Emergency tillage may be needed during a prolonged drought when vegetation is inadequate for protection against blowing. The surface is made cloddy or rough by chiseling or listing so that the impact of the wind is broken and drifting soil is trapped. Emergency tillage has only a temporary effect and may have to be repeated during the blowing season. Windbreaks of adapted shrubs and trees, such as Siberian elm or eastern redcedar, are effective in reducing soil blowing around homes and gardens.

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

irrigation

Irrigation supplements deficient rainfall on about 30,000 acres of the deep, nearly level, fertile Acuff, Estacado, Lofton, Olton, and Pullman soils.

An irrigation system should be designed according to the physical and chemical properties of the soil. It should also be designed to use water resources most efficiently in crop production. Furrow irrigation is popular on the nearly level Lofton, Olton, and Pullman soils. Less preparation and maintenance is needed for furrow irrigation than for other types. Only minor field leveling, smoothing, or planing is needed to prepare the nearly level fields for furrow irrigation. Sprinkler irrigation is best suited to gently sloping loamy soils, such as Acuff, Amarillo, Mobeetie, and Paloduro soils. The correct irrigation interval, the rate of water application, and the length of runs on gravity systems are important in water management.

Observations of irrigation wells indicate that the average decline of the underground water level is about 3.0 feet per year. Because of the depletion rate of the underground water supply, irrigation on a large scale may be fairly short lived in Oldham County. More efficient use of the remaining underground water and better methods of conserving rainwater are needed. Information on the design and application of irrigation systems for each kind of soil is available in the Technical Guide in field offices of the Soil Conservation Service.

fertility

Soil fertility is naturally high in the Acuff, Bippus,

Estacado, Lofton, Olton, Paloduro, and Pullman soils. These soils range from mildly alkaline to moderately alkaline. Bippus, Estacado, and Paloduro soils are calcareous. Additions of trace elements, such as iron, may be needed to overcome the effect of chlorosis caused by the high lime content in Estacado and Posey soils.

Experimental records show that nonirrigated crops on clayey and loamy soils do not generally make an economical response to commercial fertilizer. Fertilizer has proven profitable and advantageous, however, on irrigated soils. On all soils, additions of fertilizer and trace elements should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer.

tilth

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

Most of the cropland soils in Oldham County have a dark colored loam or clay loam surface layer. The content of organic matter is moderate to high. Generally the structure of such soils is moderate. Regular additions of crop residue, manure, and other organic material help in maintaining or improving soil structure and tilth.

crops

Field crops suited to the soils and climate of Oldham County include many that are not now commonly grown.

Figure 12.—Grain sorghum seeded in wheat stubble (no-till cultivation). The soil is Pullman clay loam, 0 to 1 percent slopes.

Grain sorghum is the chief row crop. Corn, sunflowers, soybeans, sugar beets, and similar crops can be grown under irrigation.

Winter wheat is the principal close-growing crop. Rye and spring seeded oats are sometimes grown for grazing or as green manure crops.

Special crops grown commercially in Oldham County are vegetables, small fruits, and nursery plants. These crops require supplemental irrigation. No significant acreages of special crops are grown in the county, but vegetable gardens for home use are numerous. Most of the soils in the survey area are suitable for vegetable gardens. Most of the well drained soils in the survey area are suitable for orchards and nursery plants.

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

In general, the soils in the survey area that are well suited to crops are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm development.

In some areas, there are soils that are well suited to farming but are poorly suited to nonfarm development, for example, the Pullman map unit on the general soil map at the back of this publication. The dominant soil in this area is Pullman clay loam. It produces good crop yields, but it has a high shrink-swell potential and low strength, both of which are serious hazards for nonfarm development.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

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

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

John A. Wright, range conservationist, Soil Conservation Service, helped prepare this section.

Ranching and livestock production are the most important farm enterprises in the county. Native grassland covers about 812,000 acres, or 85 percent of Oldham County (*5*). More than three-fourths of the farm income is derived from livestock, mainly cattle. Most of the rangeland is in the Canadian Breaks, which makes up the northern 82 percent of the county. There are fewer than 25 ranches, ranging from 8,000 to 150,000 acres and averaging about 33,000 acres.

Most ranches are cow-calf operations, though stocker steers make up a significant percentage of many herds. Generally, these stocker cattle are placed in nearby feedlots for finishing.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities (fig. 13) on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, calcium carbonate content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the extreme southern part of the county is the High Plains, a nearly level tableland. The soils are deep, noncalcareous loams and clay loams. They support a mixture of short and mid grasses. The production potential is medium.

The soils near the caprock escarpment at the margin of the High Plains and in the rougher areas along the Canadian River are dominantly very shallow and gravelly. They support a thin cover of mid and short grasses. The production potential is low because of the shallow root zone.

Below the caprock escarpment are gently sloping to strongly sloping soils that are mainly deep, calcareous loams, clay loams, and fine sandy loams. These soils support a mixture of mid and short grasses. They have a medium production potential but are moderately susceptible to soil blowing unless they are protected by vegetation.

On both sides of the Canadian River are several areas of deep sandy soils, which support a dense cover of tall and mid grasses. These soils have a high production potential, but the hazard of soil blowing is severe in overgrazed areas.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops

Figure 13.—Clay Loam range site. The dominant vegetation is blue grama and buffalograss. The soil is Pullman clay loam, 0 to 1 percent slopes.

from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

wildlife habitat

Gary Valentine, biologist, Soil Conservation Service, helped prepare this section.

Oldham County has a wide variety of wildlife. Antelope and blue quail inhabit the smooth, gently undulating prairies of the Canadian Breaks and the nearly level areas along the margins of the High Plains. The rough rugged terrain and the canyons along the Canadian River and its tributaries provide excellent habitat for mule deer and food for the golden eagle and bald eagle that migrate through the county each year. Some eagles nest in the areas along the river. Wild turkeys roost in the larger trees along the flood plains of some streams. Corn and grain sorghum stubble on the High Plains furnish cover and food for pheasant and blue quail. Migratory waterfowl are attracted to the nearby playas. They feed on waste grain.

Some streams are dry during the dry season. Several ponds in the Canadian Breaks, however, have been stocked with bass, channel catfish, and various kinds of sunfish.

Most landowners are interested in protecting their wildlife resources. Most do not lease hunting privileges. Species normally hunted under lease arrangement are not abundant.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be established, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland and areas such as around playas, old farmsteads, and equipment yards that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for wetland wildlife consists of open, intermittent shallow water areas (playas). Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

engineering

Dan C. Huckabee, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

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

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields,

sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, topsoil, and sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 14 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 16.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering properties

Table 16 gives estimates of the engineering properties and classifications for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. Only saturated zones within a depth of about 6 feet are indicated. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and

on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

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

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

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

engineering test data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*7*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*7*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Acuff series

The Acuff series consists of deep, well drained, dark brown soils that formed in loamy eolian deposits on the High Plains (fig. 14). Slopes are plane to convex and range from 0 to 5 percent.

Typical pedon of Acuff loan, 1 to 3 percent slopes; from intersection of Interstate Highway 40 and U.S. Highway 385 in Vega, about 4.5 miles north on U.S. Highway 385, and 900 feet east of road in rangeland:

A1—0 to 11 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; many fine roots, many fine pores; common worm casts; moderately alkaline; clear smooth boundary.

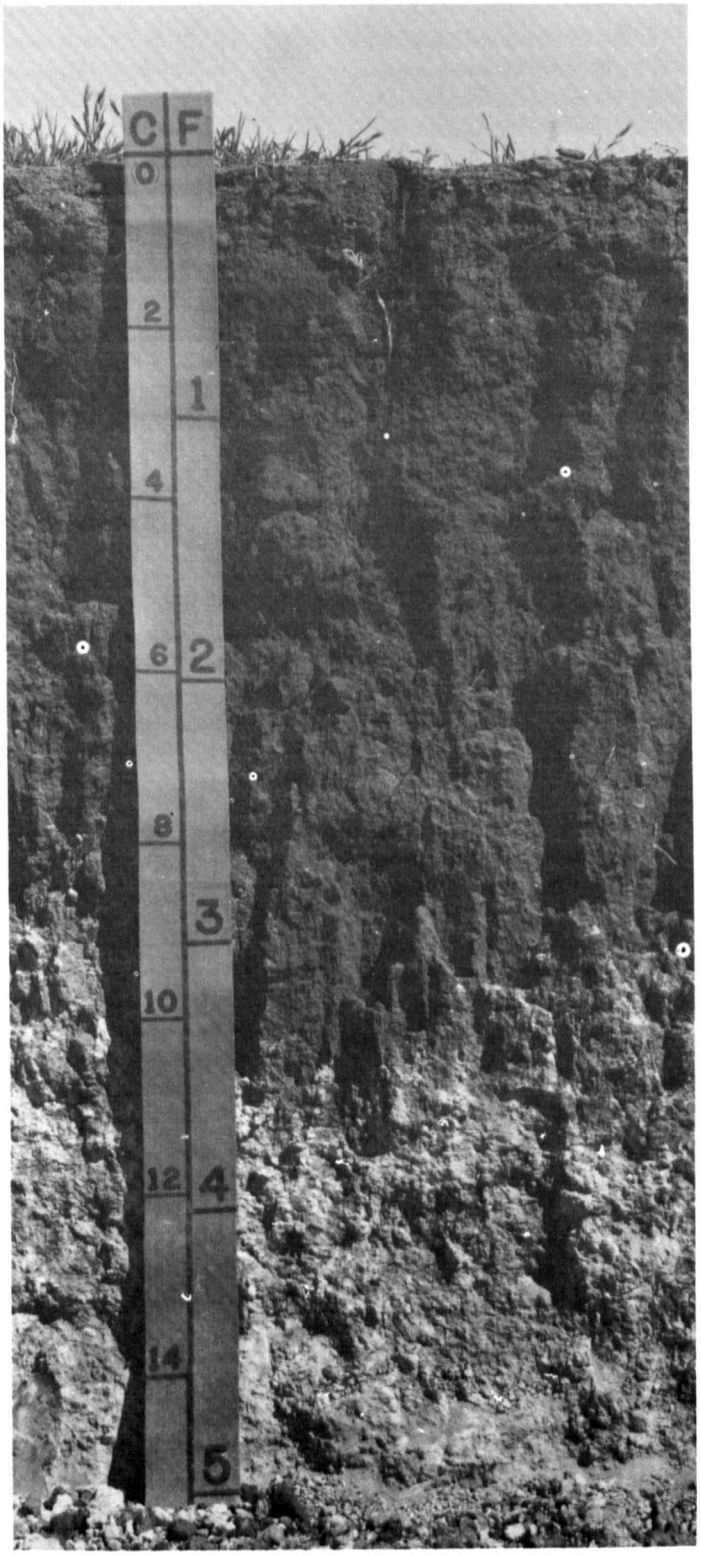


Figure 14.—Profile of Acuff loam. Depths are shown in centimeters (c) and feet (f). Multiply the figure on the left by 10 to determine the depth in centimeters.

B21t—11 to 18 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; common fine pores; common worm casts; few patchy clay films on peds; moderately alkaline; gradual smooth boundary.

B22t—18 to 24 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; common fine pores; few worm casts; few patchy clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23t—24 to 46 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few fine pores; few worm casts; few patchy clay films; few threads and films and few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—46 to 65 inches; pink (5YR 7/4) loam, light reddish brown (5YR 6/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; about 40 percent by volume calcium carbonate, of which about one-third is concretions 2 to 10 mm in diameter; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The depth to visible forms of calcium carbonate ranges from 15 to 28 inches. Depth to a calcic horizon ranges from 30 to 60 inches.

The A horizon is brown, dark brown, or reddish brown. Texture is loam or clay loam. Reaction is mildly alkaline or moderately alkaline.

The B2t horizon above the calcic horizon is brown, dark brown, reddish brown, or yellowish red. Reaction is mildly alkaline through moderately alkaline. The Btca horizon (calcic) is pink, reddish yellow, or light brown. The calcium carbonate content is 20 to 60 percent by volume.

The B2t horizon below the calcic is reddish yellow, yellowish red, reddish brown, or light reddish brown. It contains 5 to 20 percent calcium carbonate in the form of films, threads, and concretions. Texture is sandy clay loam or clay loam. Clay content ranges from 25 to 35 percent.

Amarillo series

The Amarillo series consists of deep, well drained, brown soils that formed in loamy eolian deposits on the High Plains. Slopes range from 1 to 5 percent.

Typical pedon of Amarillo fine sandy loam, 1 to 3 percent slopes; from Landergin on Interstate Highway

40, about 6.2 miles northwest on private ranch road, and 150 feet west of gate in rangeland:

A1—0 to 8 inches; brown (7.5YR 5/2) fine sandy loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; mildly alkaline; clear smooth boundary.

B21t—8 to 18 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; common fine roots; common fine pores; common worm casts; few patchy clay films; few medium and coarse pebbles of quartz; moderately alkaline; gradual smooth boundary.

B22t—18 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few fine roots; few fine pores; common worm casts; few patchy clay films; few threads and films of calcium carbonate in lower part; moderately alkaline; gradual smooth boundary.

B23tca—38 to 68 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; about 35 percent soft masses and concretions of calcium carbonate; few patchy clay films; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—68 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few patchy clay films; about 25 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to visible forms of calcium carbonate is 20 to 40 inches. Depth to a calcic horizon ranges from 30 to 60 inches.

The A horizon is fine sandy loam or loamy fine sand. Colors are light brown, brown, light reddish brown, and reddish brown. Reaction ranges from neutral through mildly alkaline.

The B2t horizon is sandy clay loam or clay loam. Clay content is 25 to 35 percent. The upper part of the B2t horizon is reddish brown, brown, reddish yellow, or yellowish red. Reaction is mildly alkaline through moderately alkaline. The Btca horizon is pink, light reddish brown, or reddish yellow. The calcium carbonate content ranges from 15 to 60 percent by volume.

The lower B2t horizon is reddish brown, reddish yellow, or yellowish red. It contains 3 to 15 percent calcium carbonate in the form of threads, films, and concretions.

Berda series

The Berda series consists of deep, well drained, brown soils formed in calcareous, loamy eolian sediment. Slopes range from 1 to 8 percent.

Typical pedon of Berda loam in an area of Berda-Veal association, undulating; from intersection of Farm Road 290 and Interstate Highway 40 in Adrian, 5.6 miles west on Interstate Highway 40, and 0.6 mile south of right-of-way in rangeland:

A1—0 to 8 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable; many fine roots; many fine pores; many worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2—8 to 20 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—20 to 44 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; common threads and films of calcium carbonate; few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

C—44 to 60 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure; hard, friable; few fine roots; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout. The solum is 40 to more than 80 inches thick. Depth to visible secondary carbonates is 0 to 14 inches.

The A horizon is reddish brown, light reddish brown, light brown, brown, dark brown, or grayish brown. It is loam, clay loam, or sandy clay loam.

The B2 horizon is brown, light brown, pale brown, grayish brown, reddish brown, or light reddish brown. The texture is loam, clay loam, or sandy clay loam that ranges from 18 to 35 percent clay. Visible calcium carbonate ranges from a few threads and films to about 20 percent by volume threads, films, and concretions.

Bippus series

The Bippus series consists of deep, well drained, dark grayish brown soils. These soils formed in calcareous loamy alluvium in valley fills and on the flood plains of small streams. Slopes range from 0 to 2 percent.

Typical pedon of Bippus clay loam, 0 to 2 percent slopes; from intersection of Interstate Highway 40 and

Farm Road 290 in Adrian, about 5.5 miles north on unimproved private road, 2.2 miles southeast on private road, and 500 feet east of windmill in rangeland:

A11—0 to 11 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

A12—11 to 25 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; common fine roots; common fine pores; common worm casts; calcarous; moderately alkaline; gradual smooth boundary.

B21—25 to 50 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few fine pores; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—50 to 72 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23—72 to 80 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable; common threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 50 inches thick.

The A horizon is 15 to 30 inches thick. It is dark brown, dark grayish brown, very dark grayish brown, or grayish brown. Reaction is mildly alkaline through moderately alkaline. Typically, the soil is calcareous within 15 inches of the surface.

The B2 horizon to 60 inches is brown, grayish brown, or dark grayish brown. The lower B2 horizon is reddish brown, brown, or yellowish red. Texture of the B2 horizon is clay loam or sandy clay loam. Calcium carbonate content ranges from barely visible threads and films to about 5 percent weakly cemented concretions.

Burson series

The Burson series consists of very shallow, well drained to excessively drained, reddish soils that formed in loamy red-bed sediment. Slopes are dominantly 30 to 70 percent.

Typical pedon of Burson loam in an area of Burson-Knoco-Rock outcrop association, steep; from intersection of Interstate Highway 40 and Farm Road 290 in Adrian, about 16 miles north and 2.0 miles northwest on unimproved ranch road, and 300 feet east of road in a canyon:

A1—0 to 6 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak fine granular structure; slightly hard, very friable; common fine roots; few fine fragments of sandstone; common pebbles of dolomite and quartz on soil surface; calcareous; moderately alkaline; clear smooth boundary.

Cr—6 to 60 inches; red (2.5YR 4/6), weakly cemented very fine grained sandstone, dark red (2.5YR 3/6) moist; vertical and horizontal cleavage planes that are coated with films of calcium carbonate; calcareous; moderately alkaline.

The soil is calcareous throughout. The solum is 3 to 12 inches thick.

The A horizon is weak red, red, reddish brown, or yellowish red. The clay content is 20 to 35 percent.

The Cr horizon is weak red, red, dark red, reddish brown, or reddish yellow. It is weakly cemented, very fine grained sandstone or siltstone interbedded with strata of soft loamy or silty material. The Cr horizon has a hardness of less than 2 on Mohs' scale.

Clairemont series

The Clairemont series consists of deep, well drained, reddish brown soils that formed in calcareous, loamy alluvium of red-bed origin. Slopes range from 0 to 2 percent.

Typical pedon of Clairemont silty clay loam, occasionally flooded; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 3.3 miles east on Farm Road 1061, and 300 feet north of right-of-way in rangeland:

A1—0 to 9 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C1—9 to 19 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable; many fine roots; common fine pores; few worm casts; common threads and films of calcium carbonate; faint bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—19 to 37 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; massive; hard, friable; few fine roots; few fine pores; few worm casts; common bedding planes; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C3—37 to 80 inches; reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few fine roots; common threads and films of calcium carbonate; common bedding planes; thin

strata of sandy clay loam material; few fine quartz pebbles; calcareous; moderately alkaline.

The soil is calcareous throughout. The 10- to 40-inch control section averages 20 to 35 percent clay but contains strata of varying texture. Some pedons have a buried A horizon up to 12 inches thick.

The A1 horizon is 6 to 12 inches thick. It is light brown, light reddish brown, brown, or reddish brown. Texture is loam, silt loam, or silty clay loam.

The C horizon is light reddish brown, reddish yellow, or reddish brown. Texture is silt loam or silty clay loam. Bedding planes are few to common.

Estacado series

The Estacado series consists of deep, well drained, brown soils formed in calcareous, loamy eolian deposits on the High Plains (fig. 15). Slopes range from 0 to 5 percent.

Typical pedon of Estacado clay loam, 1 to 3 percent slopes; from intersection of Interstate Highway 40 and Farm Road 290 in Adrian, 2.8 miles west on Interstate Highway 40, and 350 feet south of right-of-way in rangeland:

A1—0 to 8 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; many fine roots; common fine pores; common worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21t—8 to 24 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; common fine roots; common fine pores; few worm casts; few patchy clay films; calcareous; moderately alkaline; gradual wavy boundary.

B22tca—24 to 32 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; few fine pores; few worm casts; few patchy clay films; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—32 to 42 inches; pink (5YR 7/4) clay loam, pink (5YR 7/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; few patchy clay films; about 50 percent threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—42 to 62 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; about 30 percent threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

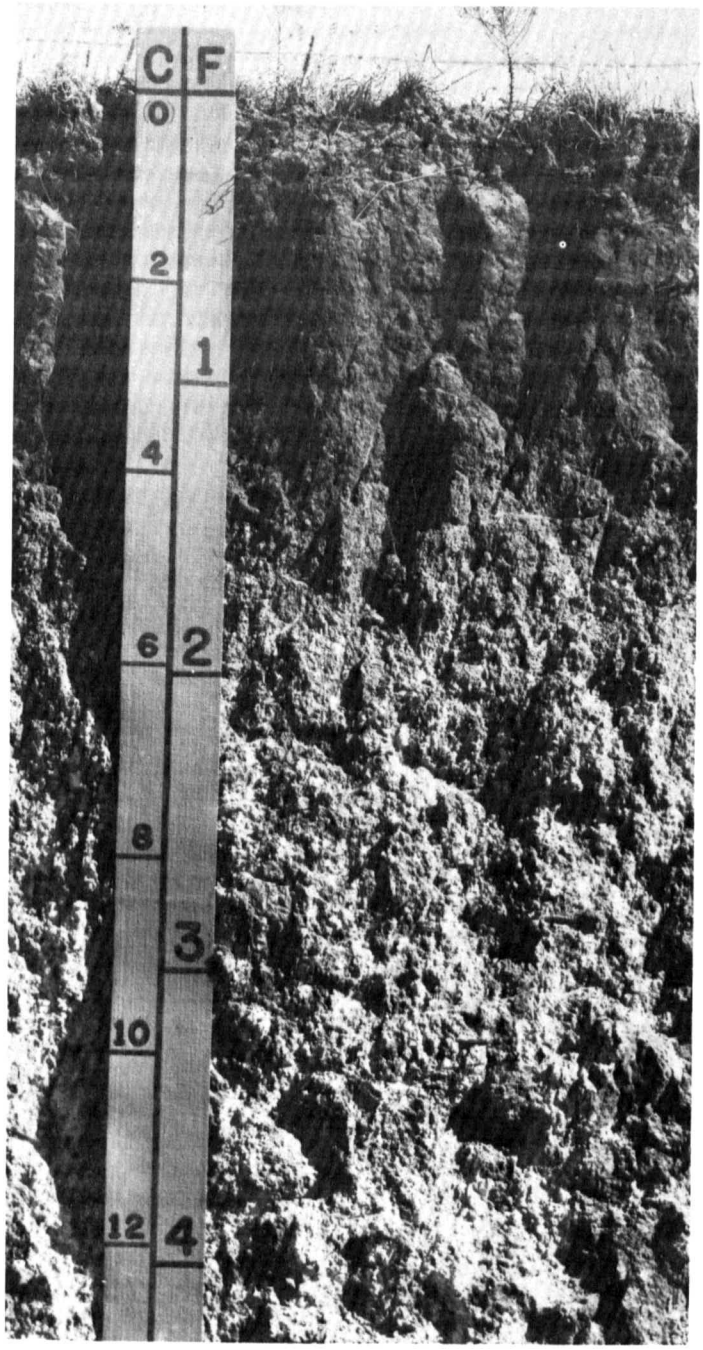


Figure 15.—Profile of Estacado clay loam. Depths are shown in centimeters (c) and feet (f). Multiply the figure on the left by 10 to determine the depth in centimeters.

The solum is 60 to more than 80 inches thick. The soil is calcareous throughout. Calcic horizons begin near the top of the Bt horizon. The maximum zone of calcium carbonate accumulation begins at depths of 10 to 30 inches.

The A horizon is 7 to 15 inches thick. It is grayish brown, brown, dark brown, or dark grayish brown.

The upper Bt horizon is brown, light brown, reddish brown, light reddish brown, reddish yellow, or strong brown. The Btca horizon is light brown, reddish brown, light reddish brown, reddish yellow, or pink. Content of visible carbonates ranges from 10 to 30 percent in the upper Btca horizon and from 20 to 50 percent in the lower Btca horizon. The content decreases as depth increases. Texture of the Bt horizon is loam, clay loam, or sandy clay loam. Clay content ranges from 20 to 30 percent.

Glenrio series

The Glenrio series consists of shallow, well drained, dark reddish brown soils formed in calcareous marine clays and shales. Slopes range from 5 to about 15 percent.

Typical pedon of Glenrio clay in an area of Quay-Glenrio-Burson association, rolling; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 5.0 miles east on Farm Road 1061, 5.8 miles south on unimproved ranch road, and 50 feet east of road in rangeland:

A1—0 to 5 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few fine weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B2—5 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; calcareous; moderately alkaline; gradual smooth boundary.

Cr—16 to 60 inches; variegated layers of reddish brown (2.5YR 4/4) and light brownish gray (10YR 6/2) shaly clay; massive; extremely hard, extremely firm; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 10 to 20 inches thick. The soil is calcareous throughout.

The A horizon is reddish brown or red silty clay or clay.

The B2 horizon is red, reddish brown, dark reddish brown, or light reddish brown clay. The content of calcium carbonate ranges from a few barely visible threads and films to 5 or 10 percent threads, films, and concretions.

The Cr horizon is shaly clay or weakly consolidated shale in shades of red, olive, and gray.

Gracemore series

The Gracemore series consists of deep, somewhat poorly drained, brown soils formed in calcareous sandy alluvium on flood plains.

Typical pedon of Gracemore soils, frequently flooded; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, about 0.5 mile north on U.S. Highway 385, 0.6 mile east on ranch road, and 50 feet south of road on a flood plain:

A1—0 to 11 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium blocky structure; very hard, firm; many fine roots; few strata of sandier material in lower part; calcareous; moderately alkaline; abrupt smooth boundary.

C1—11 to 38 inches; brown (10YR 5/3) fine sand, brown (10YR 4/3) moist; single grained; loose; common fine roots in upper part; common thin strata of fine sandy loam and loam; few quartz pebbles; calcareous; moderately alkaline; gradual smooth boundary.

C2—38 to 62 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout.

The A horizon is 6 to 15 inches thick. Texture is fine sand, loamy fine sand, fine sandy loam, very fine sandy loam, loam, or clay loam. The A horizon is brown, pale brown, reddish brown, light reddish brown, yellowish brown, light brownish gray, or grayish brown.

The C horizon is fine sand or loamy fine sand. It is reddish brown, light reddish brown, pink, brown, light brown, pale brown, very pale brown, dark grayish brown, very dark grayish brown, light gray, or gray. Bedding planes are common throughout. Depth to the permanent water table is 8 to 30 inches. In some pedons the water table is at the surface most of the time.

Gracemore soils in Oldham County are considered to be taxadjuncts to the Gracemore series because they occur in regions where the annual precipitation is less than 25 inches. Their use and management, however, are similar to those of the Gracemore series.

Knoco series

The Knoco series consists of very shallow, well drained, reddish brown soils formed in clayey red-bed shale. Slopes are 5 to 70 percent.

Typical pedon of Knoco clay in an area of Knoco-Badland association, rolling; from intersection of Interstate Highway 40 and Farm Road 809 in Wildorado, 1.0 mile north, 1.0 mile east, and 2.0 miles north on county roads, 10.1 miles north on unimproved ranch roads, and 3,600 feet west in rangeland:

A1—0 to 6 inches; reddish brown (5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak medium blocky structure; extremely hard, very firm; common fine roots; few fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cr—6 to 50 inches; reddish brown (2.5YR 5/4) clayey shale, reddish brown (2.5YR 4/4) moist; massive; extremely hard, extremely firm; few fine roots in crevices of shale; few gypsum crystals in upper part; calcareous; moderately alkaline.

Thickness of the solum over red-bed shale is 3 to 12 inches. The soil is calcareous throughout.

The A horizon is red, reddish brown, or yellowish red. It is clay or silty clay.

The Cr horizon is weakly consolidated clayey shale. Some pedons have crystals and thin strata of gypsum. Colors are red, reddish brown, olive, gray, and white that are intermingled as strata, pockets, or small discrete bodies.

Latom series

The Latom series consists of very shallow, well drained, grayish brown soils. These soils formed in material weathered from strongly cemented sandstone. Slopes are 3 to 15 percent.

Typical pedon of Latom fine sandy loam in an area of Latom-Rock outcrop complex, 3 to 15 percent slopes; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 0.6 mile south on U.S. Highway 385, and 100 feet east of road in rangeland:

A1—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable; many fine roots; common fine pores; few fine concretions of calcium carbonate; few partially weathered fragments of sandstone in the lower part; calcareous; moderately alkaline; abrupt smooth boundary.

R—8 to 60 inches; light brownish gray (10YR 6/2), strongly cemented, calcareous sandstone; thin coatings of calcium carbonate in crevices; the upper 6 inches is partially weathered.

The solum ranges from 4 to 20 inches in thickness.

The A horizon is light brown, pale brown, brown, light brownish gray, or grayish brown. It is loam or fine sandy loam. Clay content ranges from 10 to 18 percent. The R layer is light gray, light brownish gray, or gray weakly to strongly cemented sandstone.

Likes series

The Likes series consists of deep, excessively drained, grayish brown soils formed in calcareous sandy deposits. Slopes range from 1 to 8 percent.

Typical pedon of Likes loamy fine sand, 1 to 8 percent slopes; from intersection of U.S. Highway 385 and Spur 233 at Boys Ranch, 4.4 miles northwest on U.S. Highway 385, and 100 feet east of right-of-way in rangeland:

A11—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 30 inches; pale brown (10YR 6/3) loamy fine sand; brown (10YR 5/3) moist; single grained; loose; few fine roots; few quartz pebbles 0.5 to 1.0 inch in diameter; calcareous; moderately alkaline; diffuse boundary.

C2—30 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few small quartz pebbles; few threads and films of calcium carbonate; few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

This soil is calcareous and moderately alkaline throughout. The C horizon contains few to common fine concretions of calcium carbonate in most pedons.

The A horizon is 6 to 12 inches thick. It is loamy fine sand or fine sand. Colors are light brownish gray, grayish brown, dark yellowish brown, pale brown, or brown.

The C horizon is very pale brown, pale brown, pink, light yellowish brown, light brown, strong brown, or brown. Texture is loamy fine sand or fine sand.

Lincoln series

The Lincoln series consists of deep, somewhat excessively drained, light brown soils that formed in calcareous sandy alluvium on flood plains. Slopes are 0 to 3 percent.

Typical pedon of Lincoln soils, frequently flooded; from intersection of U.S. Highway 385 and Spur 233 at Boys Ranch, 2.25 miles northwest on U.S. Highway 385, and 100 feet south of right-of-way on a flood plain:

A1—0 to 8 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; common fine roots; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

C—8 to 65 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; loose; few fine roots in upper part; few small pebbles of quartz 0.5 to 1.0 inch in diameter; few thin strata of brown (7.5YR 5/4) fine sandy loam; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout. The A horizon ranges from 7 to 15 inches thick. Texture is loam, fine sandy loam, loamy fine sand,

or fine sand. Color is light brown, reddish yellow, strong brown, or brown.

The C horizon is pinkish gray, pink, reddish yellow, or light brownish gray. Texture is loamy fine sand or fine sand. Thin strata of fine sandy loam, loam, or silty clay loam occur throughout the pedon.

Lipan series

The Lipan series consists of deep, somewhat poorly drained, gray soils. These soils formed in calcareous clayey sediment on benches of playas. They crack deeply when dry. Slopes are 0 to 1 percent.

Typical pedon of Lipan clay from intersection of Interstate Highway 40 and U.S. Highway 385 in Vega, 9 miles west on Interstate Highway 40, and 3,400 feet south of right-of-way in rangeland:

A11—0 to 9 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine subangular blocky structure; extremely hard, very firm; many fine roots; many fine pores; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—9 to 19 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium blocky structure; extremely hard, very firm; many fine roots; many fine pores; few shiny pressure faces; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC—19 to 45 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; weak medium blocky structure; few intersecting grooved slickensides from 3 to 10 inches across that form parallelepipeds; extremely hard, very firm; few fine roots; few fine pores; few fine brown concretions; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—45 to 80 inches; light gray (10YR 7/1) clay, gray (10YR 6/1) moist; weak medium blocky structure; few intersecting slickensides that form parallelepipeds; extremely hard, very firm; few fine roots; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout. The solum ranges from 40 to more than 80 inches in thickness. When dry, the soil has cracks 0.5 to 1.5 inches wide extending to more than 20 inches. Gilgai microrelief is evident in undisturbed areas. The microknolls are 3 to 8 inches higher than the microdepressions. The soil texture is clay or silty clay. Grooved slickensides that intersect occur below 20 inches.

The A horizon is dark gray or gray. The AC horizon is gray, light gray, grayish brown, or light brownish gray. The Cca horizon is light brownish gray, light gray, or gray, and it contains few to common threads, films, and weakly cemented concretions of calcium carbonate.

Lofton series

The Lofton series consists of deep, moderately well drained, dark gray soils that formed in clayey eolian sediment. Slopes range from 0 to 1 percent.

Typical pedon of Lofton clay loam, 0 to 1 percent slopes; from intersection of Farm Road 809 and Interstate Highway 40 in Wildorado, 2.0 miles east on Interstate 40, and 1,400 feet south of right-of-way in rangeland:

A1—0 to 10 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable; many fine roots; many fine pores; mildly alkaline; abrupt smooth boundary.

B21t—10 to 22 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; extremely hard, very firm; common fine roots between peds; common fine pores; continuous clay films on peds; few vertical cracks filled with material from above; mildly alkaline; gradual smooth boundary.

B22t—22 to 41 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; few slickensides 3 to 6 inches across; extremely hard, very firm; common fine roots; common fine pores; thin continuous clay films on peds; few fine black concretions; few vertical cracks to a depth of about 26 inches; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—41 to 80 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; few small slickensides 3 to 6 inches across; extremely hard, very firm; few fine roots; few fine pores; few patchy clay films; about 10 percent threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 45 to more than 60 inches thick. Depth to the maximum accumulation of calcium carbonate ranges from 40 to 60 inches. When the soil is dry, cracks 0.3 to 1 inch wide extend to more than 20 inches.

The A horizon is very dark gray, dark gray, dark grayish brown, or very dark grayish brown. It is clay loam or silty clay loam that is neutral to moderately alkaline.

The B2t horizon is gray, grayish brown, dark gray, dark grayish brown, or very dark gray. Texture is clay or is silty clay that is 40 to 50 percent clay. The B2t horizon is mildly alkaline or moderately alkaline. The Btca horizon is gray, light brownish gray, grayish brown, brownish gray, brown, or pale brown. It is clay, clay loam, silty clay, or silty clay loam. Calcium carbonate content is 5 to 40 percent.

Mobeetie series

The Mobeetie series consists of deep, well drained, brown soils that formed in calcareous loamy sediment. Slopes range from 1 to 12 percent.

Typical pedon of Mobeetie fine sandy loam, 5 to 12 percent slopes; from intersection of Interstate Highway 40 and Farm Road 290 in Adrian, about 7.3 miles west on Interstate Highway 40 to its intersection with Chicago-Rock Island and Pacific Railroad, and 0.5 mile north of right-of-way in rangeland:

A1—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, brown (7.5YR 4/2) moist; weak fine granular structure; slightly hard, very friable; common fine roots; common fine pores; few worm casts; few pebbles of caliche on surface; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

B2—9 to 25 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; common fine pores; few worm casts; few strongly cemented concretions of calcium carbonate; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—25 to 45 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; few fine pores; few worm casts; common threads, films, and concretions of calcium carbonate; few pebbles of quartz; calcareous; moderately alkaline; gradual smooth boundary.

C—45 to 60 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; common fine pores; few threads and films of calcium carbonate; few quartz pebbles; calcareous; moderately alkaline.

The solum is 24 to 60 inches thick. The soil is calcareous fine sandy loam or loam.

The A horizon is brown, light brown, pale brown, light brownish gray, or grayish brown. It is 8 to 12 inches thick.

The B2 horizon is pale brown, brown, light brownish gray, grayish brown, reddish brown, light brown, or light yellowish brown. The B3ca and C horizons are pink, pinkish gray, light brown, light yellowish brown, reddish yellow, or yellowish red. The B3ca horizon is 5 to 15 percent calcium carbonate in the form of threads, films, soft masses, and concretions.

Montoya series

The Montoya series consists of deep, well drained, reddish brown soils. These soils formed in calcareous clays and shales of red-bed origin. They crack deeply when dry. Slopes are dominantly less than 1 percent. The surface is somewhat wavy and uneven.

Typical pedon of Montoya clay from intersection of interstate Highway 40 and Farm Road 290 in Adrian, 18.1 miles west on Interstate Highway 40, and 3,000 feet north of road in rangeland:

A11—0 to 3 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak platy structure parting to weak fine granular structure; very hard, very firm; many fine roots; few fine pores; calcareous; moderately alkaline; clear smooth boundary.

A12—3 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium blocky structure; extremely hard, very firm; common fine roots; few fine black concretions; few fine pores; few vertical cracks 1 to 1.5 cm wide; calcareous; moderately alkaline; gradual smooth boundary.

AC—16 to 34 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak coarse blocky structure; extremely hard, very firm; few fine roots; few very fine black concretions; common slickensides 1 to 3 inches across; few fine shale fragments; few fine gypsum crystals; calcareous; moderately alkaline; diffuse boundary.

Cca—34 to 48 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; massive; extremely hard, very firm; calcareous; moderately alkaline; gradual smooth boundary.

C—48 to 60 inches; reddish brown (2.5YR 4/4) shaly clay; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

The solum is 24 to about 44 inches thick. Texture is silty clay or clay. When dry, the soil commonly has cracks more than 0.4 inch wide to a depth of about 20 inches. It is calcareous throughout. Clay content between depths of 10 and 40 inches ranges from 40 to 60 percent.

The A horizon is brown, reddish brown, or dark reddish brown. It is 10 to 20 inches thick. The AC horizon is dark reddish brown, reddish brown, light reddish brown, red, reddish yellow, or yellowish red. The lower part has few to common threads, films, and concretions of calcium carbonate. Grooved intersecting slickensides 1 to 4 inches across are commonly below 15 inches.

The C horizon is red, reddish brown, or dark reddish brown clay or shaly clay.

Olton series

The Olton series consists of deep, well drained, dark brown soils formed in loamy eolian deposits on the High Plains. Slopes are 0 to 3 percent.

Typical pedon of Olton clay loam, 0 to 1 percent slopes; from intersection of Interstate Highway 40 and

Farm Road 290 in Adrian, 0.1 mile south on Farm Road 290 and 150 feet west of right-of-way in rangeland:

A1—0 to 6 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular and subangular blocky structure; hard, friable; many fine roots; many fine pores; mildly alkaline; clear smooth boundary.

B21t—6 to 14 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; thin clay films on peds; moderately alkaline; gradual smooth boundary.

B22t—14 to 30 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, firm; common fine roots; common fine pores; thin clay films on peds; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—30 to 52 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots; few fine pores; common clay films on peds; few threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B24tca—52 to 65 inches; pink (5YR 8/4) clay loam, reddish yellow (5YR 7/6) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; thin patchy clay films on peds; about 20 percent threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. Depth to secondary carbonates is 15 to 28 inches.

The A horizon is 6 to 15 inches thick. Texture is loam or clay loam. Color is reddish brown, brown, or dark brown. Reaction is neutral through mildly alkaline.

The B2t horizon above the zone of maximum calcium carbonate accumulation is reddish brown, dark reddish brown, brown, dark brown, or yellowish red. The texture is clay loam or clay. Reaction is mildly alkaline to moderately alkaline. The B2tca horizon is clay loam or silty clay loam. Colors are light reddish brown, reddish yellow, yellowish red, reddish brown, or pink. The calcium carbonate content ranges from 15 to 60 percent. The B2t horizon below the B2tca has less carbonates than above the B2tca. Color of the lower B2t horizon is reddish brown, brown, reddish yellow, or yellowish red. Texture is clay loam or sandy clay loam.

Posey series

The Posey series consists of deep, well drained, brown soils formed on the High Plains in calcareous loamy eolian sediment. Slopes range from 0 to 5 percent.

Typical pedon of Posey clay loam, 0 to 3 percent slopes; from intersection of Interstate Highway 40 and Farm Road 290 in Adrian, 2.1 miles west on Interstate Highway 40, and 0.25 mile south of right-of-way in rangeland:

A1—0 to 6 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; many fine pores; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21tca—6 to 18 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; common fine pores; common worm casts; few patchy clay films; about 20 percent threads, films, and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22tca—18 to 36 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine roots; few fine pores; few worm casts; few patchy clay films; about 20 percent weakly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—36 to 65 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; few fine pores; few thin patchy clay films; about 15 percent threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. A calcic horizon begins near the top of the Bt horizon. The soil is calcareous and moderately alkaline throughout.

The A horizon is 5 to 9 inches thick. Its texture is loam or clay loam. Colors are brown, light brown, grayish brown, or light reddish brown.

The Btca horizon is light reddish brown, light brown, reddish brown, reddish yellow, or yellowish red. Texture is clay loam or sandy clay loam. The content of calcium carbonate ranges from 15 to 35 percent. The calcium carbonate is in the form of threads, films, soft masses, and weakly cemented concretions.

Potter series

The Potter series consists of very shallow, well drained, calcareous gravelly soils. These soils formed in loamy sediment and caliche. Slopes range from 3 to 40 percent.

Typical pedon of Potter gravelly loam in an area of Potter gravelly loam, 3 to 12 percent slopes; from intersection of Interstate 40 and U.S. Highway 385 in Vega, 4.1 miles north on U.S. Highway 385 and 100 feet west of right-of-way in rangeland:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; common fine pores; common worm casts; many strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 8 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; few fine pores; few worm casts; about 30 percent caliche gravel; calcareous; moderately alkaline; clear smooth boundary.

Cca—8 to 30 inches; white (10YR 8/2) caliche; about 40 percent caliche fragments having a hardness of less than 3 on Mohs' scale; about 60 percent soft powdery lime and loamy material.

The A horizon is 4 to 12 inches thick. It is pinkish gray, light brownish gray, light brown, pale brown, brown, grayish brown, or dark grayish brown. Texture is gravelly loam or gravelly clay loam.

The Cca horizon is pink, reddish yellow, or white. In some pedons it is platy caliche fragments having a hardness of less than 3 Mohs' scale and some soft caliche. In others it is intermingled pockets of loamy earth, soft caliche beds, or loamy calcareous material.

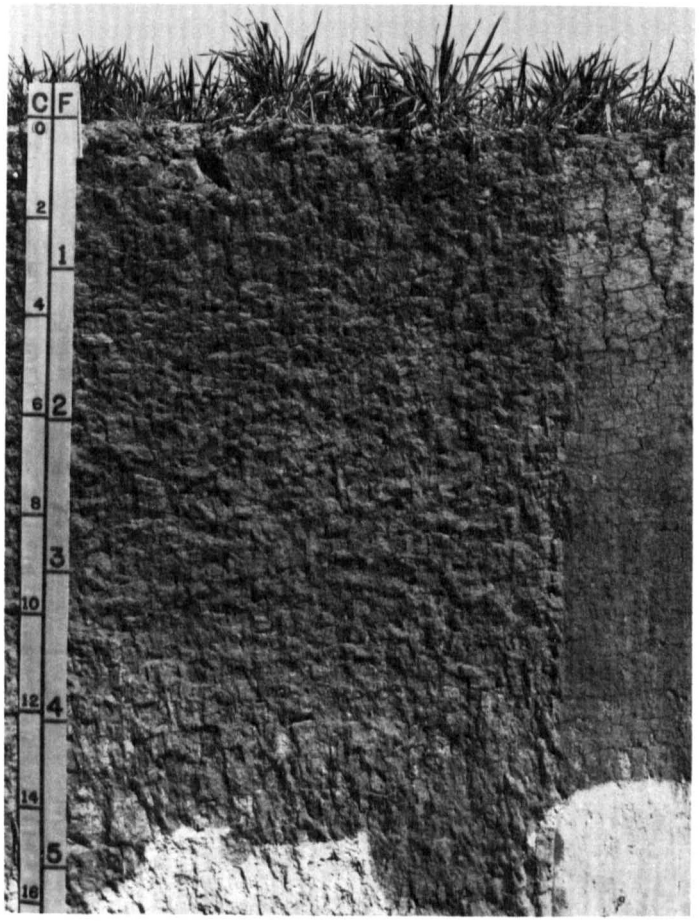


Figure 16.—Profile of Pullman clay loam. Depths are shown in centimeters (c) and feet (f). Multiply the figure on the left by 10 to determine the depth in centimeters.

Pullman series

The Pullman series consists of deep, well drained, brown soils that formed in clayey eolian sediment on the High Plains (fig. 16). Slopes range from 0 to 3 percent but are dominantly less than 1 percent.

Typical pedon of Pullman clay loam, 0 to 1 percent slopes; from intersection of U.S. Highway 385 and Interstate Highway 40 in Vega, 1.0 mile east on Interstate 40 and 100 feet north of railroad right-of-way in cultivated field:

Ap—0 to 5 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; hard, friable; few fine roots; few fine pores; mildly alkaline; clear smooth boundary.

B21t—5 to 15 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; few wedge-shaped peds; extremely hard, very firm; few fine roots on ped faces; few fine pores; thin continuous clay films; few vertical cracks; moderately alkaline; gradual smooth boundary.

B22t—15 to 24 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; few wedge-shaped peds; few slickensides 2 to 4 inches across; extremely hard, very firm; few fine roots; few fine pores; thin continuous clay films; few vertical cracks; moderately alkaline; gradual smooth boundary.

B23t—24 to 40 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few pores; thin clay films on ped faces; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24t—40 to 55 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine pores; few patchy clay films; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B25tca—55 to 80 inches; pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; moderate medium

subangular blocky structure; hard, friable; few fine pores; few patchy clay films; about 60 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B26tca—80 to 86 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; moderate medium subangular blocky structure; very hard, firm; few fine pores; few patchy clay films; about 40 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 100 inches thick. The depth to visible forms of calcium carbonate is 18 to 30 inches. Depth to the calcic horizon is 30 to 60 inches. When the soil is dry, cracks 1/4 to 1 inch wide extend to depths of 20 inches or more.

The A horizon is 5 to 11 inches thick. It is grayish brown, dark brown, brown, or dark grayish brown. Texture is clay loam or silty clay loam. Reaction ranges from neutral through moderately alkaline.

The B21t and B22t horizons are brown or dark brown. They are mildly alkaline or moderately alkaline. The B23t and B24t horizons are reddish brown, brown, or yellowish red. They are clay, silty clay, or clay loam. The Btca horizon begins at a depth of 30 to 60 inches. It is pink, light brown, or reddish yellow. Texture is clay loam or silty clay loam. Calcium carbonate content ranges from 20 to 70 percent.

Quay series

The Quay series consists of deep, well drained, reddish brown soils that formed in calcareous loamy red-bed sediment. Slopes range from 0 to 12 percent.

Typical pedon of Quay silty clay loam, 0 to 5 percent slopes; from intersection of Interstate Highway 40 and Farm Road 290 in Adrian, 18.5 miles west on Interstate Highway 40, and 3.5 miles north on ranch road, and 100 feet east of road in rangeland:

A1—0 to 8 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable; many fine roots; many fine pores; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—8 to 16 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; many fine roots; common fine pores; few worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—16 to 24 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; about 15 percent threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—24 to 36 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure; hard, friable; few fine roots; few fine pores; few threads, films, and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—36 to 66 inches; light reddish brown (5YR 6/3) silty clay loam, reddish brown (5YR 5/3) moist; massive; hard, friable; few threads, films, and fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 20 to 40 inches thick. The soil is loam, clay loam, or silty clay loam and is calcareous throughout. Depth to the zone of maximum carbonate accumulation is 12 to 24 inches.

The A horizon is reddish brown, light reddish brown, brown, or yellowish red. It is 7 to 12 inches thick.

The B2 horizon is reddish brown, light reddish brown, brown, yellowish red, or reddish yellow. Color of the B3ca horizon is light reddish brown, reddish brown, reddish yellow, pink, or yellowish red. As much as 30 percent of the B2ca and B3ca horizons is visible carbonates in the form of films, threads, and masses.

The C horizon is red, light reddish brown, reddish brown, reddish yellow, yellowish red, or pink. It is mainly partially weathered loamy or clayey red-bed sediment.

Randall series

The Randall series consists of deep, somewhat poorly drained, dark gray soils that formed in moderately alkaline clayey sediment in playas on the High Plains. These soils crack deeply when dry (fig. 17).

Typical pedon of Randall clay from intersection of Interstate Highway 40 and Farm Road 809 in Wildorado, 4.0 miles west on Interstate Highway 40, 1.8 miles north on county road, and 1,600 feet east of right-of-way in a playa:

A1—0 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky and fine granular structure; extremely hard, very firm; common wedge-shaped peds in lower part; common fine roots; common fine pores; few worm casts; few vertical cracks; calcareous; moderately alkaline; gradual smooth boundary.

AC1—20 to 52 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium blocky structure; common wedge-shaped peds; distinct intersecting slickensides; extremely hard, very firm; few fine roots; few fine pores; few small concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

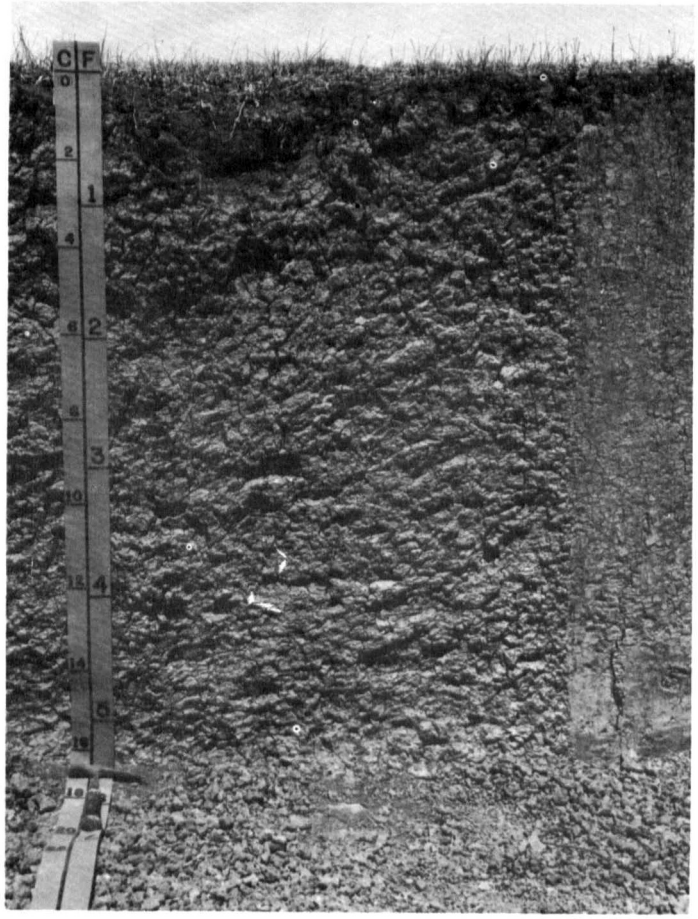


Figure 17.—Profile of Randall clay. Depths are shown in centimeters (c) and feet (f). Multiply the figure on the left by 10 to determine the depth in centimeters.

AC2—52 to 66 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; extremely hard, very firm; few slickensides 3 to 6 inches across; few fine roots; common fine strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 72 inches thick. When dry, the soil has cracks 0.5 to 1.6 inches wide that extend to depths of more than 20 inches. Gilgai microrelief is evident in undisturbed areas. The microknolls are 3 to 8 inches higher than the microdepressions. From the center of a microknoll to the center of a microdepression is 5 to 15 feet. Intersecting slickensides are at depths below 20 inches.

The A horizon ranges from 12 to 25 inches thick. It is gray or very dark gray. It is moderately alkaline and ranges from calcareous to noncalcareous. The AC horizon is gray, grayish brown, or dark grayish brown. It is moderately alkaline and calcareous.

Springer series

The Springer series consists of deep, well drained, light brown soils that formed in sandy eolian deposits. Slopes range from 0 to 3 percent.

Typical pedon of Springer loamy fine sand, 0 to 3 percent slopes; from intersection of Interstate Highway 40 and the New Mexico state line, 0.3 mile north on state line road, and 150 feet east in rangeland:

A1—0 to 10 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; loose; many fine roots; mildly alkaline; clear smooth boundary.

B2t—10 to 28 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; few fine pores; few worm casts; mildly alkaline; gradual smooth boundary.

A'2—28 to 49 inches; light reddish brown (5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) moist; single grained; loose; few fine roots; few fine pores; mildly alkaline; gradual smooth boundary.

B'2t—49 to 65 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; few patchy clay films; mildly alkaline; gradual smooth boundary.

B'3—65 to 80 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak medium blocky structure; slightly hard, very friable; moderately alkaline.

The solum is 60 to more than 80 inches thick.

The A horizon is 8 to 18 inches thick and is loamy fine sand. Reaction is neutral or mildly alkaline. Color is light brown, brown, or pale brown.

The B2t horizon is light brown, brown, reddish brown, light reddish brown, or yellowish red. Texture is fine sandy loam. Reaction is neutral or mildly alkaline. The A'2 horizon, where present, is fine sand or loamy fine sand. Color is light brown, brown, light reddish brown, or reddish yellow. The B'2t and B'3 horizons are reddish brown, reddish yellow, or yellowish red. Texture is fine sandy loam or sandy clay loam. Reaction is mildly alkaline or moderately alkaline.

Spur series

The Spur series consists of deep, well drained, dark brown soils formed in calcareous loamy alluvium on the flood plains of small streams. Slope ranges from 0 to about 2 percent but is dominantly less than 1 percent.

Typical pedon of Spur clay loam in an area of Spur and Bippus soils, frequently flooded; from intersection of Interstate Highway 40 and Farm Road 809 in Wildorado, 1.0 mile north on county road to its intersection with

another county road, 1.0 mile east and 2.0 miles north on county road, 2.3 miles northeast on unimproved ranch road, and 250 feet east on a flood plain:

A1—0 to 18 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2—18 to 30 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few threads and films of calcium carbonate; few strata of slightly darker material 1/4 to 1/2 inch thick; calcareous; moderately alkaline; gradual smooth boundary.

C1—30 to 45 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure; hard, friable; few fine roots; common fine pores; few worm casts; common threads and films of calcium carbonate; few faint bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—45 to 60 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure; hard, friable; few fine concretions of calcium carbonate; common strata of darker material; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout. Some pedons have few to common strata of a darker or lighter material.

The A horizon is loam or clay loam 10 to 20 inches thick. It is brown, dark brown, or dark grayish brown.

The B horizon is brown, reddish brown, or yellowish brown. It is loam or clay loam.

The C horizon is brown, light reddish brown, or reddish brown. It is loam or clay loam. Threads, films, and fine concretions of calcium carbonate are few to common.

Tascosa series

The Tascosa series consists of deep, well drained, dark grayish brown gravelly soils that formed on ancient beds of exposed waterworn gravel and sand (fig. 18). Slopes are 5 to about 40 percent.

Typical pedon of Tascosa very gravelly loam in an area of Tascosa very gravelly loam, hilly; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 2.25 miles south on U.S. Highway 385, and 20 feet east of right-of-way in a bank of a gravel pit:

A1—0 to 8 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; many fine pores; common worm casts; about 50 percent by volume quartz pebbles 0.25 inch to 2 inches in diameter; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

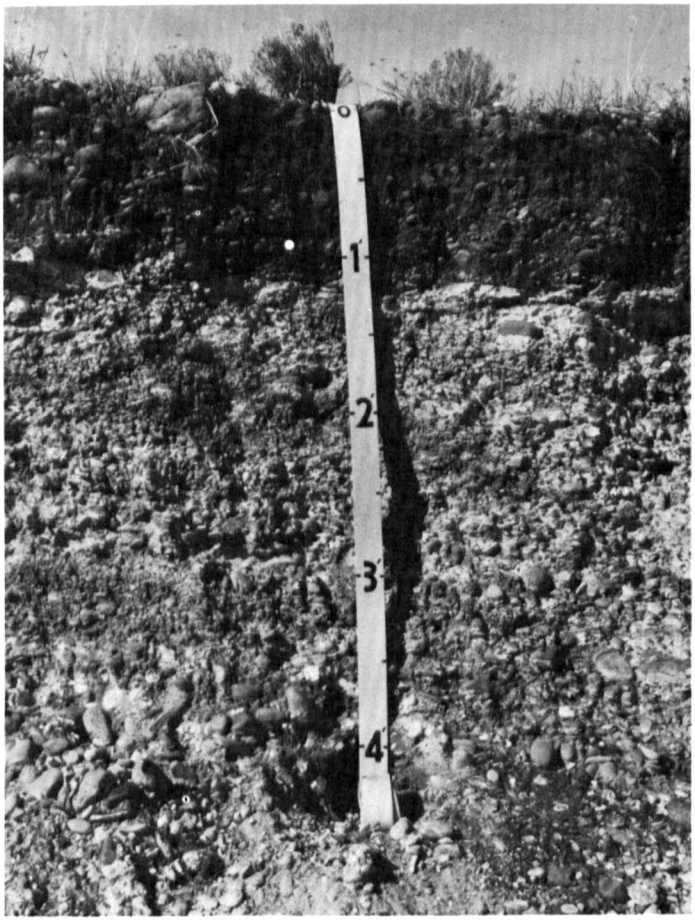


Figure 18.—Profile of Tascosa very gravelly loam. The scale is in feet.

B2ca—8 to 16 inches; grayish brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine pores; few worm casts; about 60 percent by volume quartz pebbles 0.25 inch to 2 inches in diameter; thin coatings of calcium carbonate on lower sides of pebbles; common threads, films, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C1ca—16 to 28 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; single grained; slightly hard, very friable; few fine roots; about 70 percent by volume quartz pebbles; about 50 percent of soil material less than 2 millimeters in diameter is calcium carbonate in the form of soft masses and coatings on pebbles; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; single grained; loose; 60 percent by volume quartz pebbles; about 15 percent finely divided calcium carbonate; calcareous; moderately alkaline.

The solum thickness is 14 to 22 inches. The texture of the 10- to 40-inch control section is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. Gravel content ranges from 35 to 80 percent.

The A horizon is brown, grayish brown, or dark grayish brown. Reaction is mildly alkaline or moderately alkaline.

The B2ca horizon is pinkish gray, light brown, light brownish gray, pale brown, grayish brown, or brown. It is more than 50 percent gravel and 5 to 30 percent calcium carbonate.

The Cca horizon is very pale brown, pale brown, or pinkish gray. It is 15 to 32 percent calcium carbonate. The C horizon is pink, pale brown, or very pale brown.

Tivoli series

The Tivoli series consists of deep, excessively drained, brown sandy soils. These soils formed in thick sandy eolian sediment (fig. 19). Slopes range from 3 to about 12 percent.

Typical pedon of Tivoli fine sand from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 10.3 miles north on U.S. Highway 385, 4.0 miles south on county road, 6.5 miles southwest on unimproved private road, and 3,800 feet south in rangeland:

A1—0 to 8 inches; brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) moist; single grained; loose; many fine roots; neutral; gradual smooth boundary.

C—8 to 60 inches; reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6) moist; single grained; loose; common fine roots in upper 20 inches; mildly alkaline.

The soil texture is loamy fine sand or fine sand. The A horizon is 4 to 10 inches thick. It is brown, light brown, yellowish brown, or pale brown. Reaction is neutral or mildly alkaline.

The C horizon is brown, light brown, pale brown, very pale brown, reddish yellow, pink, or light yellowish brown. Reaction is neutral to moderately alkaline. Some pedons are calcareous below 40 inches.

Veal series

The Veal series consists of deep, well drained, brown loamy soils that formed in calcareous loamy sediment. Slopes range from 3 to 12 percent but are commonly about 5 percent.

Typical pedon of Veal loam in an area of Berda-Veal association, undulating; from intersection of U.S. Highway 385 and Interstate Highway 40 in Vega, 2.0 miles north on U.S. Highway 385, 4.2 miles northeast on county road, and 400 feet east of road in rangeland:

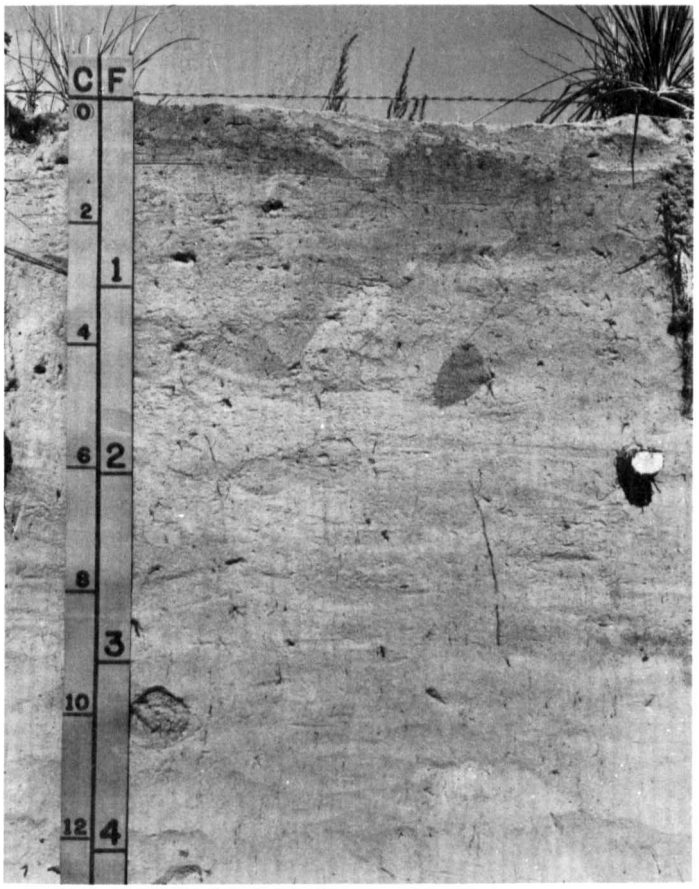


Figure 19.—Profile of Tivoli fine sand. Depths are shown in centimeters (c) and feet (f). Multiply the figure on the left by 10 to determine the depth in centimeters.

A1—0 to 6 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky and granular structure; slightly hard, friable; many fine roots; common pores; common worm casts; few fine fragments of cemented calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—6 to 17 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; common worm casts; common fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B22ca—17 to 34 inches; pinkish gray (7.5YR 7/2) clay loam, pinkish gray (7.5YR 6/2) moist; weak medium subangular blocky structure; slightly hard, friable;

few fine roots; few fine pores; about 50 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23ca—34 to 65 inches; pink (5YR 7/3) clay loam, light reddish brown (5YR 6/3) moist; weak medium subangular blocky structure; slightly hard, friable; about 40 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 40 inches thick. The calcium carbonate content in the 10- to 40-inch control section is 40 to 70 percent.

The A horizon is 5 to 8 inches thick. Color is brown, pale brown, light brownish gray, light brown, or grayish brown.

The B21 horizon is light brown, pale brown, brown, light yellowish brown, or grayish brown. It is loam, sandy clay loam, or clay loam. The B2ca horizon is pinkish gray, pink, very pale brown, or light reddish brown. It is loam, sandy clay loam, or clay loam.

Yomont series

The Yomont series consists of deep, well drained, reddish brown soils. These soils formed on flood plains in calcareous loamy alluvium of red-bed origin.

Typical pedon of Yomont very fine sandy loam in an area of Yomont very fine sandy loam, occasionally flooded; from intersection of U.S. Highway 385 and Farm Road 1061 at Tascosa, 0.5 mile north on U.S Highway 385, and 1,150 feet west of right-of-way in rangeland:

A1—0 to 10 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; slightly hard, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 37 inches; reddish brown (2.5YR 5/4) very fine sandy loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, very friable; common fine roots; common fine pores; calcareous; moderately alkaline; gradual smooth boundary.

C2—37 to 60 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable; evident bedding planes; thin strata of loamy and sandy material; calcareous; moderately alkaline.

The soil is calcareous throughout. The 10- to 40-inch control section has an average clay content of 10 to 18 percent. It is less than 15 percent material that is coarser than very fine sand.

The A horizon is 9 to 18 inches thick. It is yellowish red, reddish brown, or light reddish brown. Texture is very fine sandy loam or silt loam.

The C horizon is light reddish brown, reddish brown, yellowish red, or reddish yellow. Texture is very fine sandy loam, loam, or silty clay loam. Some pedons have strata of varying textures below 40 inches.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

factors of soil formation

The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the material. All five factors influence the characteristics of every soil, but the significance of each factor varies from one place to another. One factor may dominate soil formation in one area; in another a different factor may be important.

The factors are discussed in the following paragraphs.

parent material

Parent material has probably had more influence on the characteristics of the soils in Oldham County than any other factor. The soils developed in two geologic formations, the High Plains deposits and the underlying Triassic and Permian red beds.

The High Plains deposits consist of two parts. The upper part is an eolian mantle that is a few feet to about 100 feet thick. The lower part is the Ogallala Formation.

The eolian mantle blankets most of the High Plains of the county. It consists of alternating layers of clay loam, clay, sandy clay loam, and loam and interbedded layers of soft, pinkish-white caliche. The soil that formed at any given place appears to depend largely on the kind of parent material exposed at that place when the soil began to form. For example, Pullman soils formed in material from the finer textured layers. Estacado and Posey soils are calcareous because they formed in limy layers. Acuff and Amarillo soils formed in the less calcareous loamy sediment.

Some soils formed in reworked sediment of the eolian mantle; that is, sediment that has been washed or blown since the original deposition. Randall soils formed in material washed from the surrounding slopes into playa basins. Bippus and Spur soils formed in recent alluvium on flood plains.

The Ogallala Formation is 200 to about 700 feet thick. It consists of limy outwash loam, sand, and gravel. Potter soils developed in the thick beds of caliche in the upper part of the formation. Tascosa soils developed in the beds of quartz gravel at the base of the Ogallala Formation. Likes and Tivoli soils formed in beds of wind-worked sandy sediment. Lincoln soils formed in sandy sediment deposited along flood plains. Mobeetie soils formed in calcareous sandy loam sediment on foot slopes.

The Triassic and Permian red beds, which underlie the Ogallala Formation, make up the broken escarpment and the rough areas along creeks and canyons. Latom soils formed in sandstone strata at the top of the Triassic beds. Glenrio soils formed in clayey red beds on slopes below escarpments and on knolls. Quay soils are in loamy red bed sediment.

climate

Oldham County has a dry steppe climate. The average annual precipitation is 17.75 inches, but precipitation fluctuates greatly from year to year. Most rainfall comes in summer as short, intense showers. Winter is mostly dry and windy. Snowfall is usually light.

Climate has affected the soils of Oldham County. For example, there has not been enough rainfall to leach carbonates out of the soil. Thus, the carbonates have accumulated in the lower part of the soil at about the average depth to which rainfall penetrates. Most soils therefore are underlain by a layer of soft, pinkish caliche earth.

In Acuff, Amarillo, Olton, and Pullman soils, the free carbonates have been leached out of the upper part of the solum. In other soils forming in sediment that is high in lime, for example, Estacado and Posey soils, the process is still going on, and some free lime remains in the upper part of the solum.

In some soils, such as Pullman soils, clay is moving from the surface layer into the subsoil. Clay films, or coatings, are apparent on the surface of peds in the subsoil. The downward movement of clay is similar to that of carbonates, but it takes place at a much slower rate and apparently only after most of the carbonates have been leached out.

Local differences in climate are apparent in the escarpment area. The grass cover is denser and taller on north-facing slopes. Soils on north-facing slopes that are protected from the sun and the warm southwesterly winds are cooler and more moist than those soils on the unprotected south-facing slopes.

plant and animal life

Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. The kinds of organisms are determined mainly by climate and parent material.

The natural vegetation in Oldham County was mainly grasses. The kind of parent material in which the soil formed determined whether the grasses would be tall or short. The grasses helped to stabilize the landscape and add organic matter to the soil. Decaying roots fed bacteria and fungi and left a network of pores and tubes that helps air and water to pass through the soils.

Micro-organisms are important in soil formation. They help to break down plant residue, release plant nutrients from the parent material, and fix nitrogen from the air in the soil.

Earthworms are evident in most of the soils. Worm casts are round granular excretions left by burrowing earthworms.

Rodents, such as prairie dogs and gophers, influence the development of soils. They mix the soil material vertically as well as horizontally. Nests and burrows range from about 4 to 18 inches in width and are filled with grayish brown, silty soil material that is high in content of organic matter. Rodents tend to make soil more permeable.

The grazing, trampling, and bedding of buffalo, deer, rabbits, antelope, and other animals also have affected soil formation.

relief

Relief influences the formation of soils mainly through its effect on drainage and runoff. If the other factors of soil formation are equal, the degree of profile development depends largely on the amount of moisture entering and passing through the soils. Some soils, such as Pullman, Acuff, Amarillo, and Olton, are nearly level to gently sloping. Most of the rainfall enters these soils. In this way relief has aided their development.

Sloping soils have more runoff and absorb less water than the more nearly level soils. Therefore, they are subject to more erosion and are generally thinner. Potter soils are gently sloping to moderately steep. Because runoff is rapid and geologic erosion is active on these soils, time, vegetation, and climate can sustain only a shallow or very shallow soil.

Randall soils are affected by relief another way. They are periodically flooded and inundated and gain sediment from the surrounding areas each year.

time

Time is required for formation of a soil. The time required depends on parent material, climate, plant and animal life, and relief.

Some soils are thought to be stable in their environment. They change little as time passes, because the environmental factors have made the changes in the parent material. Acuff, Amarillo, and Pullman soils have been in place long enough to form distinct A, B, and C horizons.

In some soils climate, plant and animal life, and relief have only begun to alter the parent material. Those factors are making their impression on the soil, but more time is needed for the formation of distinct horizons. Thus, the age of a soil is determined by the degree to which the parent material has been changed toward the full development of a soil profile that has a unique set of characteristics.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

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

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

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

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

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

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Calcic horizon. A layer of secondary carbonates of calcium or magnesium precipitated from the soil solution. It may occur as a soft, thin soil horizon, a thick bed just beneath the solum, or a surface layer exposed by erosion.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

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

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

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of

the soil profile between depths of 10 inches and 40 or 80 inches.

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

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

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

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

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

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

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

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

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

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

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

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

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

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

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

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

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

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

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

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

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

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

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

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

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Playa. The flat-floored bottom of an undrained desert basin that becomes at times a shallow lake.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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

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

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

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

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Vega, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	50.6	20.0	35.3	74	-7	14	.41	.03	.69	1	3.4
February---	53.4	23.5	38.5	80	1	21	.81	.17	1.31	2	7.2
March------	60.3	28.7	44.5	84	8	79	.84	.04	1.44	2	3.6
April------	70.0	38.3	54.2	90	20	175	1.02	.18	1.68	2	.6
May--------	79.2	48.6	63.9	97	31	431	2.34	.84	3.54	4	.0
June-------	87.6	58.3	73.0	102	44	690	2.76	.87	4.28	5	.0
July-------	90.6	63.3	77.0	103	54	837	2.95	1.35	4.25	5	.0
August-----	88.8	61.7	75.3	101	52	784	2.46	1.39	3.33	5	.0
September--	81.9	53.4	67.7	97	38	531	1.62	.53	2.50	3	.0
October----	72.7	42.4	57.6	92	25	254	1.29	.20	2.14	3	.1
November---	59.2	30.1	44.7	81	9	36	.69	.04	1.16	2	2.2
December---	51.7	23.1	37.4	74	1	8	.56	.09	.91	1	3.9
Yearly:											
Average--	70.5	41.0	55.8	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	-8	---	---	---	---	---	---
Total----	---	---	---	---	---	3,860	17.75	13.99	21.32	35	21.0

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Vega, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 16	April 27	May 9
2 years in 10 later than--	April 11	April 21	May 5
5 years in 10 later than--	April 1	April 10	April 26
First freezing temperature in fall:			
1 year in 10 earlier than--	October 23	October 16	October 7
2 years in 10 earlier than--	October 28	October 21	October 12
5 years in 10 earlier than--	November 8	November 1	October 21

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-75 at Vega, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	200	179	155
8 years in 10	207	187	163
5 years in 10	220	204	178
2 years in 10	234	220	192
1 year in 10	241	229	200

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Irrigated crops and specialty crops[1]	Nonirrigated crops	Rangeland	Urban uses	Recreation areas
	Pct					
1. Quay-Burson-Glenrio	26	Very low: slope, rooting depth.	Very low: slope, droughty, rooting depth.	Medium: droughty, rooting depth.	Low: shrink-swell, slope, depth to rock.	High.
2. Mobeetie-Veal-Berda	23	Low: slope, excess lime.	Low: slope, droughty.	Medium: slope.	High	High.
3. Pullman	15	High	Medium: droughty.	Medium: droughty.	Medium: shrink-swell, low strength.	Medium: percs slowly.
4. Amarillo-Acuff	11	High	Medium: slope, erosion, droughty.	Medium: droughty.	High	High.
5. Mobeetie-Tascosa	10	Very low: slope, erosion, small stones.	Very low: slope, erosion, small stones.	Medium: small stones, slope.	Low: slope, small stones.	Very low: slope, small stones.
6. Olton-Acuff	6	High	Medium: slope, erosion, droughty.	Medium: droughty.	Medium: shrink-swell.	Medium: percs slowly.
7. Estacado-Posey	3	Medium: slope, excess lime.	Low: slope, erosion, excess lime, droughty.	Medium: droughty.	Medium: low strength.	Medium: dusty, excess lime.
8. Likes-Tivoli	3	Very low: sandy texture, soil blowing.	Very low: sandy texture, soil blowing.	Medium: sandy texture.	Low: cutbanks cave.	Low: too sandy, erodes easily.
9. Potter-Mobeetie	2	Very low: slope, rooting depth.	Very low: slope, rooting depth.	Low: rooting depth, slope.	Very low: slope, depth to rock.	High.

[1]Rating applies to areas where suitable irrigation water is available.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Acuff loam, 0 to 1 percent slopes	6,760	0.7
2	Acuff loam, 1 to 3 percent slopes	28,210	3.0
3	Acuff loam, 3 to 5 percent slopes	7,980	0.8
4	Amarillo loamy fine sand, 0 to 3 percent slopes	9,410	1.0
5	Amarillo fine sandy loam, 0 to 1 percent slopes	5,390	0.6
6	Amarillo fine sandy loam, 1 to 3 percent slopes	33,850	3.5
7	Amarillo fine sandy loam, 3 to 5 percent slopes	11,100	1.2
8	Berda-Veal association, undulating	69,800	7.3
9	Bippus clay loam, 0 to 2 percent slopes	5,040	0.5
10	Burson-Knoco-Rock outcrop association, steep	21,180	2.2
11	Clairemont silty clay loam, occasionally flooded	10,410	1.1
12	Estacado clay loam, 0 to 1 percent slopes	7,120	0.7
13	Estacado clay loam, 1 to 3 percent slopes	21,810	2.3
14	Estacado clay loam, 3 to 5 percent slopes	4,560	0.5
15	Gracemore soils, frequently flooded	2,250	0.2
16	Knoco-Badland association, rolling	14,120	1.5
17	Latom-Rock outcrop complex, 3 to 15 percent slopes	21,430	2.2
18	Likes loamy fine sand, 1 to 8 percent slopes	18,560	1.9
19	Lincoln soils, frequently flooded	11,140	1.2
20	Lipan clay	1,200	0.1
21	Lofton clay loam, 0 to 1 percent slopes	980	0.1
22	Mobeetie fine sandy loam, 0 to 3 percent slopes	15,440	1.6
23	Mobeetie fine sandy loam, 3 to 5 percent slopes	22,160	2.3
24	Mobeetie fine sandy loam, 5 to 12 percent slopes	25,600	2.7
25	Mobeetie-Tascosa association, rolling	39,200	4.1
26	Mobeetie-Veal association, undulating	71,280	7.5
27	Montoya clay	9,420	1.0
28	Olton clay loam, 0 to 1 percent slopes	16,080	1.7
29	Olton clay loam, 1 to 3 percent slopes	11,300	1.2
30	Posey clay loam, 0 to 3 percent slopes	6,510	0.7
31	Posey clay loam, 3 to 5 percent slopes	2,470	0.3
32	Potter gravelly loam, 3 to 12 percent slopes	8,050	0.8
33	Potter-Mobeetie association, steep	11,640	1.2
34	Pullman clay loam, 0 to 1 percent slopes	115,750	12.1
35	Pullman clay loam, 1 to 3 percent slopes	13,390	1.4
36	Quay silty clay loam, 0 to 5 percent slopes	76,650	8.0
37	Quay-Glenrio-Burson association, rolling	101,530	10.6
38	Randall clay	4,000	0.4
39	Springer loamy fine sand, 0 to 3 percent slopes	14,140	1.5
40	Spur and Bippus soils, frequently flooded	4,740	0.5
41	Tascosa very gravelly loam, hilly	49,310	5.2
42	Tivoli fine sand	8,110	0.8
43	Yomont very fine sandy loam, occasionally flooded	6,850	0.7
	Water	10,240	1.1
	Total	956,160	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat		Grain sorghum		Corn	
	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu
1---------- Acuff	18	50	25	120	---	150
2---------- Acuff	16	45	20	100	---	135
3---------- Acuff	14	40	15	80	---	100
4---------- Amarillo	12	40	20	100	---	135
5---------- Amarillo	15	50	25	110	---	150
6---------- Amarillo	12	45	20	100	---	135
7---------- Amarillo	10	40	15	75	---	100
8*:						
Berda----------	---	---	---	---	---	---
Veal----------	---	---	---	---	---	---
9---------- Bippus	16	50	20	100	---	140
10*:						
Burson----------	---	---	---	---	---	---
Knoco----------	---	---	---	---	---	---
Rock outcrop.						
11---------- Clairemont	25	60	40	110	---	---
12---------- Estacado	18	45	25	100	---	160
13---------- Estacado	15	40	20	90	---	140
14---------- Estacado	12	35	15	70	---	---
15---------- Gracemore	---	---	---	---	---	---
16*:						
Knoco----------	---	---	---	---	---	---
Badland.						
17*:						
Latom----------	---	---	---	---	---	---
Rock outcrop.						
18---------- Likes	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF PRINCIPAL CROPS--Continued

Soil name and map symbol	Wheat		Grain sorghum		Corn	
	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu
19. Lincoln						
20 Lipan	15	---	20	125	---	---
21 Lofton	15	55	20	140	---	150
22 Mobeetie	12	35	15	60	---	---
23 Mobeetie	10	30	12	50	---	---
24 Mobeetie	---	---	---	---	---	---
25*:						
Mobeetie	---	---	---	---	---	---
Tascosa	---	---	---	---	---	---
26*:						
Mobeetie	---	---	---	---	---	---
Veal	---	---	---	---	---	---
27 Montoya	---	---	---	---	---	---
28 Olton	16	60	20	125	---	160
29 Olton	14	50	15	110	---	140
30 Posey	12	35	15	70	---	---
31 Posey	10	30	12	60	---	---
32 Potter	---	---	---	---	---	---
33*:						
Potter	---	---	---	---	---	---
Mobeetie	---	---	---	---	---	---
34 Pullman	15	60	20	125	---	165
35 Pullman	12	50	15	100	---	140
36 Quay	---	---	---	---	---	---
37*:						
Quay.						
Glenrio	---	---	---	---	---	---
Burson	---	---	---	---	---	---
38 Randall	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat		Grain sorghum		Corn	
	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu
39---------- Springer	---	---	20	75	---	---
40*:						
Spur----------	---	---	---	---	---	---
Bippus----------	---	---	---	---	---	---
41---------- Tascosa	---	---	---	---	---	---
42---------- Tivoli	---	---	---	---	---	---
43---------- Yomont	25	60	40	100	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class		Total acreage	Major management concerns (Subclass)			
			Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
			Acres	Acres	Acres	Acres
I	(N)	---	---	---	---	---
	(I)	---	---	---	---	---
II	(N)	24,006	6,746	17,260	---	---
	(I)	60,336	42,096	17,260	980	---
III	(N)	154,650	153,450	1,200	---	---
	(I)	140,670	140,670	---	---	---
IV	(N)	71,820	71,820	---	---	---
	(I)	124,920	124,920	---	---	---
V	(N)	5,283	---	5,283	---	---
VI	(N)	391,233	324,987	4,000	62,246	---
VII	(N)	83,477	12,766	---	70,711	---
VIII	(N)	---	---	---	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1, 2, 3 Acuff	Clay Loam	Favorable	2,100	Blue grama	40
		Normal	1,600	Buffalograss	20
		Unfavorable	1,200	Vine-mesquite	5
				Sideoats grama	5
				Tobosa	5
4 Amarillo	Loamy Sand	Favorable	2,800	Little bluestem	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,200	Blue grama	5
				Plains bristlegrass	5
				Sand dropseed	5
				Sand bluestem	5
				Sand lovegrass	5
				Hairy grama	5
5, 6, 7 Amarillo	Sandy Loam	Favorable	2,800	Blue grama	30
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,400	Buffalograss	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
8*:					
Berda	Hardland Slopes	Favorable	2,400	Sideoats grama	35
		Normal	2,000	Blue grama	20
		Unfavorable	1,400	Little bluestem	5
				Buffalograss	5
				Wright threeawn	5
				Silver bluestem	5
				Plains bristlegrass	5
Veal	Loamy	Favorable	2,000	Sideoats grama	40
		Normal	1,500	Blue grama	20
		Unfavorable	1,100	Buffalograss	10
				Little bluestem	5
				Sand dropseed	5
9 Bippus	Draw	Favorable	2,600	Sideoats grama	10
		Normal	2,200	Vine-mesquite	15
		Unfavorable	1,800	Blue grama	20
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	15
10*:					
Burson	Rough Breaks	Favorable	700	Sideoats grama	20
		Normal	500	Little bluestem	15
		Unfavorable	300	Blue grama	10
				Sand bluestem	5
				Silver bluestem	5
Knoco	Shallow Clay	Favorable	1,400	Sideoats grama	30
		Normal	1,000	Tobosa	10
		Unfavorable	600	Buffalograss	10
				Vine-mesquite	5
				Hairy grama	5
				Silver bluestem	5
				Purple threeawn	5
				Rough tridens	5
				Blue grama	15

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
10*:					
Rock outcrop.					
11 Clairemont	Loamy Bottomland	Favorable	3,400	Sideoats grama	10
		Normal	2,600	Sand bluestem	15
		Unfavorable	1,500	Indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	10
				Western wheatgrass	10
12, 13, 14 Estacado	Loamy	Favorable	2,200	Blue grama	30
		Normal	1,700	Sideoats grama	25
		Unfavorable	1,300	Buffalograss	15
				Vine-mesquite	5
15 Gracemore	Wet Bottomland	Favorable	9,000	Switchgrass	15
		Normal	7,500	Sand bluestem	10
		Unfavorable	5,000	Indiangrass	10
				Eastern gamagrass	5
				Beaked panicum	10
				Canada wildrye	5
				Scribner panicum	5
				Purpletop	5
				Maximilian sunflower	5
				Sedges	15
16*:					
Knoco	Shallow Clay	Favorable	1,400	Sideoats grama	30
		Normal	1,000	Tobosa	10
		Unfavorable	600	Buffalograss	10
				Vine-mesquite	5
				Hairy grama	5
				Silver bluestem	5
				Purple threeawn	5
				Rough tridens	5
				Blue grama	15
Badland.					
17*:					
Latom	Very Shallow	Favorable	1,000	Sideoats grama	30
		Normal	750	Blue grama	10
		Unfavorable	500	Black grama	10
				Little bluestem	10
				Buffalograss	5
				Sand bluestem	5
				Hairy grama	5
				Silver bluestem	5
Rock outcrop.					
18 Likes	Loamy Sand	Favorable	3,000	Little bluestem	20
		Normal	2,100	Sand bluestem	10
		Unfavorable	1,300	Sideoats grama	25
				Indiangrass	5
				Switchgrass	10
				Canada wildrye	5
				Sand sagebrush	5
				Blue grama	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
19*---------- Lincoln	Sandy Bottomland----------	Favorable	3,400	Switchgrass----------	20
		Normal	2,280	Sand bluestem----------	15
		Unfavorable	1,800	Indiangrass----------	15
				Little bluestem----------	5
				Texas bluegrass----------	5
				Purpletop----------	5
				Maximilian sunflower----------	5
				Goldenrod----------	5
				Heath aster----------	5
				Tamarisk----------	5
20---------- Lipan	Lakebed----------	Favorable	4,000	Western wheatgrass----------	20
		Normal	2,500	Buffalograss----------	20
		Unfavorable	500	Vine-mesquite----------	10
				Knotgrass----------	10
				Blue grama----------	10
21---------- Lofton	Clay Loam----------	Favorable	2,200	Blue grama----------	45
		Normal	1,800	Buffalograss----------	25
		Unfavorable	1,200	Vine-mesquite----------	10
				Western wheatgrass----------	5
				Sand dropseed----------	5
22, 23, 24--------- Mobeetie	Mixedland Slopes----------	Favorable	2,500	Sideoats grama----------	30
		Normal	2,250	Blue grama----------	15
		Unfavorable	1,500	Little bluestem----------	10
				Sand bluestem----------	5
				Plains bristlegrass----------	5
				Sand dropseed----------	5
				Indiangrass----------	5
				Hairy grama----------	5
25*:					
Mobeetie----------	Mixedland Slopes----------	Favorable	2,500	Sideoats grama----------	30
		Normal	2,250	Blue grama----------	15
		Unfavorable	1,500	Little bluestem----------	10
				Sand bluestem----------	5
				Plains bristlegrass----------	5
				Sand dropseed----------	5
				Indiangrass----------	5
				Hairy grama----------	5
Tascosa----------	Gravelly----------	Favorable	1,800	Sideoats grama----------	30
		Normal	1,500	Little bluestem----------	15
		Unfavorable	1,000	Black grama----------	15
				Hairy grama----------	10
				Blue grama----------	5
				Sand bluestem----------	5
				Indiangrass----------	5
26*:					
Mobeetie----------	Mixedland Slopes----------	Favorable	2,500	Sideoats grama----------	30
		Normal	2,250	Blue grama----------	15
		Unfavorable	1,500	Little bluestem----------	10
				Sand bluestem----------	5
				Plains bristlegrass----------	5
				Sand dropseed----------	5
				Indiangrass----------	5
				Hairy grama----------	5
Veal----------	Loamy----------	Favorable	2,000	Sideoats grama----------	40
		Normal	1,500	Blue grama----------	20
		Unfavorable	1,100	Buffalograss----------	10
				Little bluestem----------	5
				Sand dropseed----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
27 Montoya	Clay Flat	Favorable	2,000	Alkali sacaton	15
		Normal	1,200	Galleta	40
		Unfavorable	800	Blue grama	10
				Vine-mesquite	5
				Inland saltgrass	5
				Fourwing saltbush	5
				Sideoats grama	10
28, 29 Olton	Clay Loam	Favorable	2,100	Blue grama	45
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	5
				Tobosa	5
				Sideoats grama	5
30, 31 Posey	Loamy	Favorable	2,200	Sideoats grama	40
		Normal	1,800	Blue grama	20
		Unfavorable	1,400	Vine-mesquite	5
				Little bluestem	5
				Buffalograss	5
				Sand dropseed	5
32 Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	5
				Rough tridens	5
				Hairy grama	5
				Black grama	5
				Wrights threeawn	5
33*:					
Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	5
				Rough tridens	5
				Hairy grama	5
				Black grama	5
				Wrights threeawn	5
Mobeetie	Mixedland Slopes	Favorable	2,500	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5
34, 35 Pullman	Clay Loam	Favorable	2,000	Blue grama	50
		Normal	1,500	Buffalograss	20
		Unfavorable	1,000	Sideoats grama	5
				Western wheatgrass	5
				Vine-mesquite	5
				Silver bluestem	5
				Tobosa	5
36 Quay	Clay Loam	Favorable	2,000	Blue grama	40
		Normal	1,600	Galleta	10
		Unfavorable	1,200	Buffalograss	15
				Sideoats grama	5
				Sand dropseed	5
				Threeawn	5
				Broom snakeweed	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
37*:					
Quay	Clay Loam	Favorable	2,000	Blue grama	40
		Normal	1,600	Galleta	10
		Unfavorable	1,200	Buffalograss	15
				Sideoats grama	5
				Sand dropseed	5
				Threeawn	5
				Broom snakeweed	5
Glenrio	Shallow Clay	Favorable	1,250	Sideoats grama	25
		Normal	1,000	Galleta	15
		Unfavorable	750	Blue grama	15
				Buffalograss	10
				Black grama	5
				Vine-mesquite	5
				Hairy grama	5
Burson	Rough Breaks	Favorable	700	Sideoats grama	20
		Normal	500	Little bluestem	15
		Unfavorable	300	Blue grama	10
				Sand bluestem	5
				Silver bluestem	5
38 Randall	Lakebed	Favorable	4,000	Pennsylvania smartweed	20
		Normal	2,000	Blue grama	10
		Unfavorable	50	Common spikesedge	15
				Buffalograss	10
				Western wheatgrass	20
				Knotgrass	5
39 Springer	Loamy Sand	Favorable	2,800	Little bluestem	15
		Normal	2,100	Sideoats grama	20
		Unfavorable	1,400	Blue grama	5
				Plains bristlegrass	5
				Sand dropseed	5
				Sand bluestem	10
				Indiangrass	5
				Switchgrass	10
40*:					
Spur	Draw	Favorable	2,600	Sideoats grama	10
		Normal	2,200	Vine-mesquite	15
		Unfavorable	1,800	Blue grama	20
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	15
Bippus	Draw	Favorable	2,600	Sideoats grama	10
		Normal	2,200	Vine-mesquite	15
		Unfavorable	1,800	Blue grama	20
				Western wheatgrass	10
				Little bluestem	5
				White tridens	5
				Buffalograss	15
41 Tascosa	Gravelly	Favorable	1,800	Sideoats grama	30
		Normal	1,500	Little bluestem	15
		Unfavorable	1,000	Black grama	15
				Hairy grama	10
				Blue grama	5
				Sand bluestem	5
				Indiangrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
42 Tivoli	Sand Hills	Favorable	2,000	Little bluestem	15
		Normal	1,400	Sand bluestem	10
		Unfavorable	1,000	Big sandreed	10
				Sideoats grama	10
				Sand lovegrass	5
				Switchgrass	5
				Sand dropseed	5
				Lespedeza	5
				Indiangrass	5
43 Yomont	Loamy Bottomland	Favorable	3,600	Sand bluestem	15
		Normal	2,700	Sideoats grama	10
		Unfavorable	1,750	Indiangrass	10
				Western wheatgrass	10
				Switchgrass	5
				Little bluestem	10
				Vine-mesquite	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1, 2, 3 Acuff	---	Green ash, osageorange, Russian-olive, Arizona cypress, Rocky Mt. juniper.	Honeylocust, oriental arborvitae.	Siberian elm	---
4, 5, 6, 7 Amarillo	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
8*:					
Berda	---	Osageorange, eastern redcedar, oriental arborvitae.	---	Siberian elm	---
Veal	---	Oriental arborvitae, Rocky Mt. juniper, Russian-olive, osageorange, eastern redcedar.	Honeylocust, Siberian elm.	---	---
9 Bippus	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
10*:					
Burson	---	---	---	---	---
Knoco	---	---	---	---	---
Rock outcrop.					
11 Clairemont	---	Russian-olive, Rocky Mt. juniper, green ash, eastern redcedar, osageorange, Arizona cypress.	Honeylocust, oriental arborvitae.	Siberian elm	---
12, 13, 14 Estacado	---	Osageorange, eastern redcedar, oriental arborvitae, Rocky Mt. juniper.	---	Siberian elm	---
15 Gracemore	---	---	---	---	---
16*:					
Knoco	---	---	---	---	---
Badland	---	---	---	---	---
17*:					
Latom	---	---	---	---	---
Rock outcrop.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
18 Likes	---	Russian-olive, eastern redcedar.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
19* Lincoln	---	---	---	---	---
20 Lipan	---	---	---	---	---
21 Lofton	---	Russian-olive, Rocky Mt. juniper.	Honeylocust, oriental arborvitae, eastern redcedar.	Siberian elm	---
22, 23, 24 Mobeetie	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm	---
25*:					
Mobeetie	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm	---
Tascosa	---	---	---	---	---
26*:					
Mobeetie	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm	---
Veal	---	Oriental arborvitae, Rocky Mt. juniper, Russian-olive, osageorange, eastern redcedar.	Honeylocust, Siberian elm.	---	---
27 Montoya	---	---	---	---	---
28, 29 Olton	---	Green ash, osageorange, Russian-olive, eastern redcedar, Arizona cypress, Rocky Mt. juniper.	Honeylocust, oriental arborvitae.	Siberian elm	---
30, 31 Posey	---	Osageorange, eastern redcedar, oriental arborvitae.	Honeylocust, Arizona cypress.	Siberian elm	---
32 Potter	---	---	---	---	---
33*:					
Potter	---	---	---	---	---
Mobeetie	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
34, 35 Pullman	---	Osageorange, Russian-olive.	Eastern redcedar, honeylocust, Arizona cypress, oriental arborvitae.	Siberian elm	---
36 Quay	---	Osageorange, eastern redcedar, oriental arborvitae.	Honeylocust, Arizona cypress.	Siberian elm	
37*:					
Quay	---	---	---	---	---
Glenric	---	---	---	---	---
Burson	---	---	---	---	---
38 Randall	---	---	---	---	---
39 Springer	---	Russian-olive, eastern redcedar.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
40*:					
Spur	---	Russian-olive, eastern redcedar.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
Bippus	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
41 Tascosa	---	---	---	---	---
42 Tivoli	---	---	---	---	---
43 Yomont	---	Green ash, osageorange, Russian-olive, eastern redcedar, Arizona cypress, Rocky Mt. juniper.	Honeylocust, oriental arborvitae.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Acuff	Slight	Slight	Slight	Slight.
2, 3 Acuff	Slight	Slight	Moderate: slope.	Slight.
4 Amarillo	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
5 Amarillo	Slight	Slight	Slight	Slight.
6, 7 Amarillo	Slight	Slight	Moderate: slope.	Slight.
8*:				
Berda	Slight	Slight	Moderate: slope.	Slight.
Veal	Slight	Slight	Moderate: slope.	Slight.
9 Bippus	Severe: floods.	Moderate: floods, too clayey.	Moderate: too clayey.	Moderate: too clayey.
10*:				
Burson	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Knoco	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.
Rock outcrop.				
11 Clairemont	Severe: floods.	Slight	Moderate: too clayey, floods.	Slight.
12 Estacado	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
13, 14 Estacado	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
15 Gracemore	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.
16*:				
Knoco	Severe: depth to rock.	Moderate: slope, too clayey.	Severe: slope, too clayey, depth to rock.	Moderate: too clayey.
Badland.				

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17*:				
Latom	Severe: depth to rock.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
Rock outcrop.				
18 Likes	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
19* Lincoln	Severe: floods.	Moderate: too sandy, floods.	Severe: floods.	Moderate: floods, too sandy.
20 Lipan	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey.
21 Lofton	Severe: percs slowly.	Moderate: too clayey, wetness.	Severe: percs slowly.	Moderate: too clayey.
22 Mobeetie	Slight	Slight	Slight	Slight.
23 Mobeetie	Slight	Slight	Moderate: slope.	Slight.
24 Mobeetie	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
25*:				
Mobeetie	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tascosa	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
26*:				
Mobeetie	Slight	Slight	Severe: slope.	Slight.
Veal	Slight	Slight	Severe: slope.	Slight.
27 Montoya	Severe: floods.	Moderate: floods, too clayey.	Severe: too clayey.	Moderate: too clayey.
28, 29 Olton	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
30 Posey	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
31 Posey	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
32 Potter	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
33*:				
Potter	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope, small stones.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
33*:				
Mobeetie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
34, 35 Pullman	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
36 Quay	Moderate: too clayey.	Moderate: too clayey.	Moderate: dusty.	Moderate: too clayey.
37*:				
Quay	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Glenrio	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.
Burson	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: depth to rock, slope.	Slight.
38 Randall	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
39 Springer	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
40*:				
Spur	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Bippus	Severe: floods.	Moderate: floods, too clayey.	Severe: floods.	Moderate: floods.
41 Tascosa	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Moderate: small stones.
42 Tivoli	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.
43 Yomont	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

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

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1, 2, 3 Acuff	Good*	Fair	Good	Fair	Very poor.	Very poor.	Good*	Very poor	Good.
4 Amarillo	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
5, 6, 7 Amarillo	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
8**:									
Berda	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
Veal	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
9 Bippus	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
10**:									
Burson	Very poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
Knoco	Very poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
Rock outcrop.									
11 Clairemont	Good	Good	Fair	Good	Very poor.	Very poor.	Good	---	Fair.
12, 13, 14 Estacado	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
15 Gracemore	Poor	Fair	Fair	---	Fair	Poor	Fair	Poor	---
16**:									
Knoco	Very poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
Badland.									
17**:									
Latom	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
Rock outcrop.									
18 Likes	Poor	Fair	Fair	Good	Very poor.	Very poor.	Fair	Very poor	Fair.
19** Lincoln	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
20 Lipan	Good*	Fair	Poor	Very poor.	Poor	Fair	Good*	Poor	Poor.
21 Lofton	Good*	Good	Poor	Fair	Poor	Poor	Good*	Poor	Poor.

See footnotes at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
22, 23 Mobeetie	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
24 Mobeetie	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
25**:									
Mobeetie	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
Tascosa	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
26**:									
Mobeetie	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
Veal	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
27 Montoya	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor	Fair.
28, 29 Olton	Good*	Fair	Fair	Fair	Very poor.	Very poor.	Good*	Very poor	Fair.
30, 31 Posey	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
32 Potter	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
33**:									
Potter	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Mobeetie	Very poor	Very poor.	Good	Fair	Very poor.	Very poor.	Poor	Very poor	Good.
34, 35 Pullman	Good*	Fair	Fair	Fair	Very poor.	Very poor.	Good*	Very poor	Fair.
36 Quay	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
37**:									
Quay	Poor	Fair	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
Glenrio	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Burson	Very poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
38 Randall	Poor	Poor	Fair	Poor	Fair	Good	Poor	Good	Poor.
39 Springer	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
40**:									
Spur	Very poor	Poor	Good	Good	Very poor.	Very poor.	Poor	Very poor	Fair.
Bippus	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.

See footnotes at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
41---------- Tascosa	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
42---------- Tivoli	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
43---------- Yomont	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor	Fair.

* This rating applies to irrigated cropland where food and cover is available for pheasant. Nonirrigated cropland is one class lower.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1, 2 Acuff	Slight	Slight	Slight	Slight	Moderate: low strength.
3 Acuff	Slight	Slight	Slight	Slight	Moderate: low strength.
4, 5, 6, 7 Amarillo	Slight	Slight	Slight	Slight	Moderate: low strength.
8*:					
Berda	Slight	Slight	Slight	Slight	Moderate: low strength.
Veal	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
9 Bippus	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
10*:					
Burson	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Knoco	Severe: too clayey, slope, depth to rock.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
11 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
12, 13 Estacado	Slight	Slight	Slight	Slight	Moderate: low strength.
14 Estacado	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
15 Gracemore	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
16*:					
Knoco	Severe: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Badland.					
17*:					
Latom	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Rock outcrop.					
18 Likes	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
19*---------- Lincoln	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
20---------- Lipan	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell, low strength.
21---------- Lofton	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
22---------- Mobeetie	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
23---------- Mobeetie	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight.
24---------- Mobeetie	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
25*:					
Mobeetie---------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Tascosa----------	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
26*:					
Mobeetie---------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight.
Veal----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.
27---------- Montoya	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell, low strength.
28, 29---------- Olton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
30---------- Posey	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
31---------- Posey	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight.
32---------- Potter	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
33*:					
Potter----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mobeetie---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
34, 35---------- Pullman	Severe: too clayey, cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
36---------- Quay	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
37*:					
Quay	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Glenrio	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Burson	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock, slope.
38 Randall	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.
39 Springer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
40*:					
Spur	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Bippus	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
41 Tascosa	Severe: small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
42 Tivoli	Severe: cutbanks cave, too sandy.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
43 Yomont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

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

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Acuff	Slight	Moderate: seepage.	Slight	Slight	Good.
2, 3 Acuff	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
4, 5, 6, 7 Amarillo	Slight	Moderate: seepage.	Slight	Slight	Good.
8*:					
Berda	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Veal	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
9 Bippus	Moderate: floods.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
10*:					
Burson	Severe: slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, slope.
Knoco	Severe: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: too clayey, slope.
Rock outcrop.					
11 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
12 Estacado	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
13, 14 Estacado	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
15 Gracemore	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: floods, seepage, wetness.	Severe: wetness, floods, seepage.	Poor: too sandy.
16*:					
Knoco	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Poor: too clayey.
Badland.					
17*:					
Latom	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: area reclaim.
Rock outcrop.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18 Likes	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
19* Lincoln	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Fair: too sandy.
20 Lipan	Severe: floods, percs slowly.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
21 Lofton	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
22, 23 Mobeetie	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
24 Mobeetie	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
25*:					
Mobeetie	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Tascosa	Moderate: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
26*:					
Mobeetie	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Veal	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
27 Montoya	Severe: percs slowly.	Severe: floods.	Severe: too clayey.	Moderate: floods.	Poor: too clayey.
28 Olton	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
29 Olton	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
30 Posey	Slight	Moderate: seepage.	Slight	Slight	Good.
31 Posey	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
32 Potter	Moderate: slope.	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
33*:					
Potter	Severe: slope.	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, small stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
33*:					
Mobeetie	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope.	Poor: slope.
34 Pullman	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
35 Pullman	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
36 Quay	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
37*:					
Quay	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Glenrio	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Burson	Moderate: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
38 Randall	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
39 Springer	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
40*:					
Spur	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Bippus	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
41 Tascosa	Severe: slope.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
42 Tivoli	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
43 Yomont	Severe: floods.	Severe: floods, seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

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

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2, 3 Acuff	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4 Amarillo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
5, 6, 7 Amarillo	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
8*:				
Berda	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Veal	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
9 Bippus	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
10*:				
Burson	Poor: slope, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines.	Poor: slope, thin layer.
Knoco	Poor: low strength, shrink-swell, slope.	Unsuited: excess fines, thin layer.	Unsuited: excess fines.	Poor: too clayey, slope.
Rock outcrop.				
11 Clairemont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
12, 13, 14 Estacado	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
15 Gracemore	Fair: low strength, wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
16*:				
Knoco	Poor: low strength, shrink-swell.	Unsuited: excess fines, thin layer.	Unsuited: excess fines.	Poor: too clayey.
Badland.				
17*:				
Latom	Poor: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines.	Poor: area reclaim, thin layer.
Rock outcrop.				
18 Likes	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
19* Lincoln	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20 Lipan	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
21 Lofton	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
22, 23 Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
24 Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
25*:				
Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Tascosa	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
26*:				
Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Veal	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
27 Montoya	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
28, 29 Olton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
30, 31 Posey	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
32 Potter	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
33*:				
Potter	Fair: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, small stones.
Mobeetie	Fair: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
34, 35 Pullman	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
36 Quay	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
37*:				
Quay	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Glenrio	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
37*:				
Burson	Poor: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer.
38 Randall	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
39 Springer	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
40*:				
Spur	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Bippus	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
41 Tascosa	Fair: slope.	Fair	Fair	Poor: small stones.
42 Tivoli	Good	Fair	Unsuited: excess fines.	Poor: too sandy.
43 Yomont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

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

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
1, 2, 3 Acuff	Moderate: seepage.	Slight	Severe: no water.	Favorable	Favorable	Favorable.
4 Amarillo	Moderate: seepage.	Moderate: seepage, piping.	Severe: no water.	Erodes easily, too sandy.	Too sandy	Favorable.
5, 6, 7 Amarillo	Moderate: seepage.	Moderate: seepage, piping.	Severe: no water.	Erodes easily	Favorable	Favorable.
8*:						
Berda	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Veal	Moderate: seepage.	Moderate: piping.	Severe: no water.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.
9 Bippus	Moderate: seepage.	Slight	Severe: no water.	Erodes easily	Favorable	Favorable.
10*:						
Burson	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Rooting depth	Slope, depth to rock.	Slope, rooting depth.
Knoco	Severe: slope.	Severe: thin layer.	Severe: no water.	Droughty, rooting depth, slope.	Slope, depth to rock, percs slowly.	Slope, droughty, rooting depth.
Rock outcrop.						
11 Clairemont	Moderate: seepage.	Slight	Severe: no water.	Floods	Not needed	Erodes easily.
12, 13, 14 Estacado	Moderate: seepage.	Slight	Severe: no water.	Erodes easily, slope.	Favorable	Favorable.
15 Gracemore	Severe: seepage.	Moderate: unstable fill, piping.	Slight	Wetness, seepage, floods.	Not needed	Wetness, seepage.
16*:						
Knoco	Severe: slope.	Severe: thin layer.	Severe: no water.	Droughty, rooting depth, slope.	Slope, depth to rock, percs slowly.	Slope, droughty, rooting depth.
Badland.						
17*:						
Latom	Severe: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Soil blowing, rooting depth, slope.	Slope, depth to rock, soil blowing.	Slope, rooting depth, droughty.
Rock outcrop.						
18 Likes	Severe: seepage.	Severe: erodes easily, seepage, piping.	Severe: no water.	Erodes easily, fast intake.	Too sandy	Erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
19*: Lincoln	Severe: seepage.	Severe: seepage.	Severe: no water.	Fast intake, floods, soil blowing.	Not needed	Droughty.
20: Lipan	Slight	Moderate: compressible, unstable fill.	Severe: no water.	Floods, slow intake.	Percs slowly	Percs slowly.
21: Lofton	Slight	Moderate: compressible.	Severe: no water.	Slow intake	Not needed	Favorable.
22, 23, 24: Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
25*:						
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Tascosa	Severe: seepage.	Moderate: piping.	Severe: deep to water.	Slope, droughty.	Slope	Slope, droughty.
26*:						
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Veal	Moderate: seepage.	Moderate: low strength, piping.	Severe: no water.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.
27: Montoya	Slight	Moderate: unstable fill, hard to pack.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
28, 29: Olton	Moderate: seepage.	Moderate: piping.	Severe: no water.	Slow intake	Favorable	Favorable.
30, 31: Posey	Moderate: seepage.	Moderate: piping, seepage.	Severe: no water.	Slope, excess lime, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
32: Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
33*:						
Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
34, 35: Pullman	Slight	Moderate: shrink-swell, low strength.	Severe: no water.	Slow intake	Favorable	Favorable.
36: Quay	Moderate: slope, seepage.	Moderate: piping.	Severe: no water.	Slope, erodes easily.	Favorable	Favorable.
37*:						
Quay	Moderate: slope, seepage.	Moderate: piping.	Severe: no water.	Slope, erodes easily.	Favorable	Favorable.
Glenrio	Slight	Moderate: compressible.	Severe: no water.	Droughty, slow intake.	Slope, rooting depth.	Droughty, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
37*:						
Burson	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Rooting depth	Slope, depth to rock.	Slope, rooting depth.
38 Randall	Slight	Moderate: unstable fill, hard to pack.	Severe: no water.	Slow intake, wetness.	Not needed	Not needed.
39 Springer	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Fast intake, erodes easily.	Too sandy, erodes easily.	Erodes easily.
40*:						
Spur	Moderate: seepage.	Moderate: shrink-swell.	Severe: no water.	Floods	Favorable	Favorable.
Bippus	Moderate: seepage.	Slight	Severe: no water.	Floods	Favorable	Favorable.
41 Tascosa	Severe: seepage.	Moderate: piping.	Severe: no water.	Slope, droughty.	Slope	Slope, droughty.
42 Tivoli	Severe: seepage.	Severe: unstable fill, seepage, piping.	Severe: no water.	Complex slope, erodes easily, droughty.	Complex slope, erodes easily, fast intake, too sandy.	Erodes easily, droughty, seepage.
43 Yomont	Severe: seepage.	Severe: piping.	Severe: no water.	Floods, soil blowing.	Not needed	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
1, 2, 3---------- Acuff	0-11	Loam----------	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	8-16
	11-46	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	46-65	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
4---------- Amarillo	0-9	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	95-100	15-35	<22	NP-4
	9-37	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6	0	100	100	95-100	35-65	20-40	7-20
	37-60	Sandy clay loam, clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	90-100	90-100	65-98	35-70	20-35	7-17
5, 6, 7---------- Amarillo	0-8	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	100	100	95-100	30-55	17-25	3-7
	8-38	Sandy clay loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	95-100	35-65	20-40	7-20
	38-80	Sandy clay loam, clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	90-100	90-100	65-98	35-70	20-35	7-17
8*:											
Berda----------	0-8	Loam----------	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	8-60	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
Veal----------	0-6	Loam----------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	70-98	36-75	20-35	5-17
	6-17	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	17-65	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20
9---------- Bippus	0-25	Clay loam-------	CL, SC, SM-SC, CL-ML	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	25-80	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20
10*:											
Burson----------	0-6	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	50-85	18-30	3-12
	6-60	Weathered bedrock, variable.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
10*:											
Knoco	0-4	Clay	CL, CH	A-7-6, A-6	0-5	90-100	90-100	90-100	80-98	32-60	14-38
	4-40	Weathered bedrock.	CL, CH	A-7-6, A-6	0-5	90-100	85-100	60-100	60-95	30-60	13-38
Rock outcrop.											
11 Clairemont	0-80	Silty clay loam	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	20-40	7-20
12, 13, 14 Estacado	0-8	Clay loam	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	8-24	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	24-62	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
15 Gracemore	0-11	Loam	SM, ML, CL, CL-ML, SC	A-4, A-6	0	100	98-100	94-100	36-97	<40	NP-18
	11-62	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
16*:											
Knoco	0-6	Clay	CL, CH	A-7-6, A-6	0-5	90-100	90-100	90-100	80-98	32-60	14-38
	6-50	Weathered bedrock.	CL, CH	A-7-6, A-6	0-5	90-100	85-100	60-100	60-95	30-60	13-38
Badland.											
17*:											
Latom	0-8	Fine sandy loam	SM, SM-SC	A-4, A-2-4	0-5	80-100	75-98	70-90	25-45	<25	NP-7
	8-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
18 Likes	0-60	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4	0-2	90-100	90-98	75-95	10-30	<25	NP-6
19* Lincoln	0-8	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	8-65	Stratified fine sand to clay loam.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
20 Lipan	0-45	Clay	CH	A-7-6	0-15	85-100	80-100	80-100	80-95	55-75	32-49
	45-80	Clay, silty clay	CH, CL	A-7-6	0-15	85-100	80-100	80-100	70-95	46-66	25-40
21 Lofton	0-10	Clay loam	CL	A-6, A-7	0	100	100	98-100	70-90	35-45	15-25
	10-41	Clay, silty clay	CL	A-6, A-7	0	100	100	95-100	70-90	38-50	20-30
	41-80	Clay, silty clay, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	60-80	30-45	15-25
22, 23, 24 Mobeetie	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	25-65	18-25	2-7
25*:											
Mobeetie	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	25-65	18-25	2-7

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
25*:											
Tascosa	0-9	Gravelly sandy loam.	SM, GM, GP-GC, GC	A-1, A-2	0-5	40-65	25-60	15-50	10-26	25-42	5-16
	9-15	Very gravelly loam, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GC, GC	A-1, A-2	0-5	28-60	20-50	15-45	8-25	25-40	5-14
	15-60	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	GM, SM, GC, GP-GC	A-1, A-2	0-5	30-60	30-60	15-45	5-15	<32	NP-14
26*:											
Mobeetie	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	25-65	18-25	2-7
Veal	0-6	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	70-98	36-75	20-35	5-17
	6-17	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	17-60	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20
27 Montoya	0-16	Clay	CL, CH	A-6, A-7	0	100	100	90-100	70-96	30-55	10-35
	16-60	Clay	CL, CH	A-7, A-6	0	95-100	95-100	90-100	75-97	35-55	15-35
28, 29 Olton	0-6	Clay loam	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-38	8-22
	6-52	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	52-65	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-90	20-40	8-25
30, 31 Posey	0-6	Clay loam	CL, SC, SM-SC, CL-ML	A-4, A-6	0	98-100	95-100	85-100	36-90	20-35	5-18
	6-36	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	80-100	45-90	22-40	7-25
	36-65	Sandy clay loam, clay loam.	CL	A-4, A-6	0	85-100	85-100	80-100	51-85	25-40	8-25
32 Potter	0-8	Gravelly loam	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	8-30	Variable	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
33*:											
Potter	0-7	Gravelly loam	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	7-60	Variable	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Mobeetie	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	25-65	18-25	2-7

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
34, 35---------- Pullman	0-5	Clay loam--------	CL	A-6, A-7-6	0	100	100	95-100	70-95	30-50	15-30
	5-40	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	85-98	41-55	22-35
	40-80	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	95-100	90-100	80-100	75-95	30-50	15-30
36---------- Quay	0-8	Clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	90-100	85-100	65-80	30-40	15-20
	8-66	Clay loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	99-100	98-100	85-100	55-80	25-35	5-17
37*:											
Quay----------	0-9	Silty clay loam	CL	A-4, A-6	0	90-100	90-100	85-100	65-80	30-40	15-20
	9-70	Clay loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	99-100	98-100	85-100	55-80	25-35	5-17
Glenrio----------	0-16	Clay----------	CL, CH	A-7	0-5	90-100	85-100	80-100	70-95	45-60	25-38
	16-60	Shaly clay------	CL, CH	A-6, A-7	0	85-100	80-100	70-95	55-80	40-55	22-35
Burson----------	0-7	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	50-85	18-30	3-12
	7-50	Weathered bedrock, variable.	---	---	---	---	---	---	---	---	---
38---------- Randall	0-66	Clay----------	CL, CH	A-7-6	0	100	100	95-100	75-98	41-70	22-45
39---------- Springer	0-10	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	10-28	Fine sandy loam	SM, SM-SC, SP-SM	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
	28-49	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	49-80	Fine sandy loam, sandy clay loam.	SM, SM-SC, SC, SP-SM	A-2-4, A-4	0	98-100	95-100	75-99	11-45	18-25	2-8
40*:											
Spur----------	0-18	Clay loam--------	CL, CL-ML	A-4, A-6, A-7-6	0	100	95-100	90-100	51-95	25-45	7-25
	18-60	Loam, clay loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6, A-7-6	0	100	95-100	90-100	45-95	22-45	7-25
Bippus----------	0-18	Clay loam--------	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	18-80	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
41---------- Tascosa	0-8	Very gravelly loam.	SM, GM, GP-GC, GC, GW-GC	A-1, A-2	0-5	40-65	25-60	15-50	10-26	25-42	5-16
	8-16	Very gravelly loam, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GC, GC, GW-GC	A-1, A-2	0-5	28-60	20-50	15-45	8-25	21-40	5-14
	16-60	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	GM, SM, GC, GP-GC, GW-GC	A-1, A-2	0-5	30-60	30-60	15-45	5-15	<32	NP-14
42---------- Tivoli	0-8	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP
	8-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	98-100	80-98	5-20	---	NP
43---------- Yomont	0-60	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	98-100	90-100	51-90	<30	NP-12

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	In/hr	In/in	pH				
1, 2, 3---------- Acuff	0-11	15-30	0.6-2.0	0.12-0.18	6.6-7.8	Low----------	0.28	5	5
	11-46	25-35	0.6-2.0	0.14-0.19	7.4-8.4	Low----------	0.32		
	46-65	20-35	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.32		
4---------- Amarillo	0-9	5-15	2.0-6.0	0.06-0.10	6.6-7.8	Very low-------	0.15	5	2
	9-37	20-35	0.6-2.0	0.14-0.18	7.4-8.4	Low----------	0.32		
	37-60	20-35	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.32		
5, 6, 7---------- Amarillo	0-8	10-18	2.0-6.0	0.11-0.15	6.6-7.8	Low----------	0.24	5	3
	8-38	20-35	0.6-2.0	0.14-0.18	7.4-8.4	Low----------	0.32		
	38-80	20-35	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.32		
8*:									
Berda----------	0-8	15-35	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28	5	4L
	8-60	18-35	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28		
Veal----------	0-6	15-35	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.28	4	4L
	6-17	20-35	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.28		
	17-65	20-35	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.28		
9---------- Bippus	0-25	15-35	0.6-2.0	0.14-0.20	7.4-8.4	Moderate-------	0.28	5	6
	25-80	20-35	0.6-2.0	0.14-0.20	7.9-8.4	Moderate-------	0.28		
10*:									
Burson----------	0-6	15-35	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.43	1	---
	6-60	---	---	---	---	----------	----		
Knoco----------	0-4	40-60	<0.06	0.10-0.17	7.9-8.4	High----------	0.32	1	---
	4-40	40-60	<0.06	0.-0.08	7.9-8.4	High----------	----		
Rock outcrop.									
11---------- Clairemont	0-80	18-35	0.6-2.0	0.16-0.22	7.9-8.4	Low----------	0.43	5	6
12, 13, 14------- Estacado	0-8	18-30	0.6-2.0	0.14-0.19	7.9-8.4	Low----------	0.28	5	4L
	8-24	20-35	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.32		
	24-62	20-35	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.32		
15---------- Gracemore	0-11	---	0.2-6.0	0.11-0.24	7.4-8.4	Low----------	0.28	5	---
	11-62	---	2.0-6.0	0.05-0.11	7.9-8.4	Low----------	0.17		
16*:									
Knoco----------	0-6	40-60	<0.06	0.10-0.17	7.9-8.4	High----------	0.32	1	4
	6-50	40-60	<0.06	0.-0.08	7.9-8.4	High----------	----		
Badland.									
17*:									
Latom----------	0-8	5-18	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.24	1	3
	8-60	---	---	---	---	----------	----		
Rock outcrop.									
18---------- Likes	0-60	5-15	2.0-6.0	0.04-0.10	7.4-8.4	Very low-------	0.15	5	2
19*---------- Lincoln	0-8	5-15	6.0-20	0.06-0.11	7.4-8.4	Low----------	0.17	5	2
	8-65	5-15	6.0-20	0.02-0.08	7.9-8.4	Low----------	0.17		
20---------- Lipan	0-45	40-60	<0.06	0.13-0.18	7.4-8.4	Very high------	0.32	5	4
	45-80	40-60	<0.06	0.13-0.18	7.9-8.4	Very high------	0.32		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	In/hr	In/in	pH				
21---------- Lofton	0-10	30-40	0.2-0.6	0.16-0.20	6.6-8.4	Moderate--------	0.32	5	6
	10-41	40-50	<0.06	0.16-0.20	7.4-8.4	High----------	0.32		
	41-80	35-50	0.06-0.2	0.12-0.16	7.9-8.4	Moderate--------	0.32		
22, 23, 24-------- Mobeetie	0-60	10-18	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
25*:									
Mobeetie---------	0-60	10-18	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
Tascosa----------	0-9	5-18	0.6-2.0	0.06-0.12	7.9-8.4	Very low--------	0.24	4	---
	9-15	5-18	0.6-2.0	0.05-0.10	7.9-8.4	Very low--------	0.24		
	15-60	5-18	2.0-6.0	0.03-0.07	7.9-8.4	Very low--------	0.24		
26*:									
Mobeetie---------	0-60	10-18	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
Veal----------	0-6	15-35	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.28	4	4L
	6-17	20-35	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.28		
	17-60	20-35	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.28		
27---------- Montoya	0-16	30-60	0.2-0.6	0.19-0.21	7.4-8.4	High----------	0.37	5	4
	16-60	40-60	<0.06	0.14-0.16	7.4-8.4	High----------	0.37		
28, 29---------- Olton	0-6	22-35	0.6-2.0	0.15-0.20	6.6-8.4	Moderate--------	0.32	5	6
	6-52	35-45	0.2-0.6	0.14-0.19	7.4-8.4	Moderate--------	0.32		
	52-65	25-40	0.2-0.6	0.10-0.16	7.9-8.4	Moderate--------	0.32		
30, 31---------- Posey	0-6	15-30	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.28	3	4L
	6-36	25-35	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.32		
	36-65	20-35	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.32		
32---------- Potter	0-8	18-25	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	8-30	---	0.6-6.0	0.-0.06	7.9-8.4	Low----------	----		
33*:									
Potter----------	0-7	18-25	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	7-60	---	0.6-6.0	0.-0.06	7.9-8.4	Low----------	----		
Mobeetie---------	0-60	10-18	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
34, 35---------- Pullman	0-5	27-40	0.2-0.6	0.14-0.19	6.6-8.4	Moderate--------	0.32	5	6
	5-40	40-55	<0.06	0.12-0.17	7.4-8.4	High----------	0.37		
	40-80	38-50	0.06-0.2	0.10-0.16	7.9-8.4	Moderate--------	0.37		
36---------- Quay	0-8	18-35	0.6-2.0	0.13-0.15	7.9-8.4	Low----------	0.32	5	4L
	8-66	18-35	0.6-2.0	0.19-0.21	7.9-8.4	Moderate--------	0.37		
37*:									
Quay----------	0-9	18-35	0.6-2.0	0.13-0.15	7.9-8.4	Low----------	0.32	5	4L
	9-70	18-35	0.6-2.0	0.19-0.21	7.9-8.4	Moderate--------	0.37		
Glenrio----------	0-16	35-55	<0.06	0.12-0.17	7.9-8.4	High----------	0.32	1	4
	16-60	40-60	<0.06	0.-0.08	7.9-8.4	High----------	----		
Burson----------	0-7	15-35	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.43	1	---
	7-50	---	---	---	---	----------	----		
38---------- Randall	0-66	40-60	<0.06	0.12-0.18	7.4-8.4	Very high------	0.32	5	4
39---------- Springer	0-10	5-15	6.0-20	0.06-0.10	6.6-7.8	Very low--------	0.17	5	2
	10-28	10-18	2.0-6.0	0.10-0.15	6.6-8.4	Low----------	0.20		
	28-49	5-15	6.0-20	0.06-0.10	6.6-8.4	Very low--------	0.20		
	49-80	10-25	0.6-6.0	0.10-0.16	6.6-8.4	Low----------	0.20		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	In/hr	In/in	pH				
40*:									
Spur	0-18	20-35	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	0.28	5	6
	18-60	20-35	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	0.28		
Bippus	0-18	15-35	0.6-2.0	0.14-0.20	7.4-8.4	Moderate	0.28	5	6
	18-80	20-35	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	0.28		
41 Tascosa	0-8	5-18	0.6-2.0	0.06-0.12	7.9-8.4	Very low	0.24	4	---
	8-16	5-18	0.6-2.0	0.05-0.10	7.9-8.4	Very low	0.24		
	16-60	5-18	2.0-6.0	0.03-0.07	7.9-8.4	Very low	0.24		
42 Tivoli	0-8	---	6.0-20.0	0.05-0.11	6.1-7.8	Low	0.17	5	1
	8-60	---	6.0-20.0	0.02-0.06	6.1-8.4	Low	0.17		
43 Yomont	0-60	10-18	2.0-6.0	0.16-0.22	7.9-8.4	Low	0.49	5	3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1, 2, 3---------- Acuff	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
4, 5, 6, 7-------- Amarillo	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
8*:											
Berda----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Veal----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
9---------- Bippus	B	Rare---------	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
10*:											
Burson----------	C	None---------	---	---	>6.0	---	---	3-12	Rippable	Low------	Low.
Knoco----------	D	None---------	---	---	>6.0	---	---	3-12	Rippable	High-----	Low.
Rock outcrop.											
11---------- Clairemont	B	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	Moderate	Low.
12, 13, 14-------- Estacado	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
15---------- Gracemore	C	Frequent----	Very brief	Apr-Aug	1.0-3.0	Apparent	Nov-May	>60	---	Low------	Low.
16*:											
Knoco----------	D	None---------	---	---	>6.0	---	---	3-12	Rippable	High-----	Low.
Badland.											
17*:											
Latom----------	D	None---------	---	---	>6.0	---	---	8-20	Rippable	Low------	Low.
Rock outcrop.											
18---------- Likes	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low.
19*---------- Lincoln	A	Frequent----	Very brief to brief.	Apr-Oct	5.0-8.0	Apparent	Nov-May	>60	---	Low------	Low.
20---------- Lipan	D	Rare---------	Brief-----	Apr-Jun	>6.0	---	---	>60	---	High-----	Low.
21---------- Lofton	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
22, 23, 24-------- Mobeetie	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low.
25*:											
Mobeetie---------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low.
Tascosa----------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
26*:											
Mobeetie	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
Veal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
27 Montoya	D	Rare	Very brief	Jun-Sep	>6.0	---	---	>60	---	High	Moderate.
28, 29 Olton	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
30, 31 Posey	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
32 Potter	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
33*:											
Potter	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
Mobeetie	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
34, 35 Pullman	D	None	---	---	>6.0	---	---	>60	---	High	Low.
36 Quay	B	None	---	---	>6.0	---	---	>60	---	High	Low.
37*:											
Quay	B	None	---	---	>6.0	---	---	>60	---	High	Low.
Glenrio	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Burson	C	None	---	---	>6.0	---	---	3-12	Rip-pable	Low	Low.
38 Randall	D	Common	Long to very long.	May-Nov	>6.0	---	---	>60	---	High	Low.
39 Springer	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
40*:											
Spur	B	Frequent	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
Bippus	B	Frequent	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
41 Tascosa	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
42 Tivoli	A	None	---	---	>6.0	---	---	>60	---	Low	Low.
43 Yomont	B	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	Low	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]											Liquid limit[2]	Plasticity index[2]	Moisture density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--							Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Veal loam:[3] (S76TX-359-010)																			
A1------- 0 to 6	A-6 (04)	CL	0	100	100	99	97	94	89	57	--	22	15	30	11	2.64	18.0	6.0	1.7
B22ca----17 to 34	A-6 (07)	CL	0	100	100	100	99	98	95	71	--	53	34	31	12	2.67	19.0	6.2	1.7
Pullman clay loam:[4] (S76TX-359-001)																			
Ap------- 0 to 8	A-6 (14)	CL	0	100	100	100	100	100	100	93	--	28	18	32	16	2.63	17.0	7.7	1.8
B21t----- 8 to 22	A-7-6(26)	CL	0	100	100	100	100	100	100	95	--	47	39	44	26	2.67	13.0	14.3	1.9
B24t-----42 to 56	A-6 (23)	CL	0	100	100	100	100	99	99	90	--	38	36	40	26	2.70	14.0	12.4	1.8
B25tca---56 to 80	A-6 (14)	CL	0	100	100	100	100	100	99	89	--	44	36	30	18	2.70	15.0	8.4	1.9
Olton clay loam:[5] (S76TX-359-002)																			
A1------- 0 to 6	A-6 (15)	CL	0	100	100	100	100	100	99	80	--	34	28	37	21	2.65	16.0	10.2	1.8
B21t----- 6 to 14	A-7-6(26)	CL	0	100	100	100	100	100	100	88	--	44	38	46	29	2.67	14.0	14.3	1.8
B23t-----30 to 52	A-7-6(26)	CL	0	100	100	100	100	99	98	90	--	39	36	44	28	2.70	12.0	14.7	1.9
B24tca---52 to 65	A-6 (20)	CL	0	100	100	100	100	99	98	88	--	52	44	38	23	2.71	15.0	11.5	1.8
Berda clay loam:[6] (S76TX-359-003)																			
B21------ 8 to 15	A-4 (02)	CL	0	100	100	100	99	97	92	53	--	16	13	26	8	2.65	17.0	4.6	1.7
Quay silty clay loam:[7] (S76TX-359-004)																			
A1------- 0 to 8	A-6 (10)	CL	0	100	100	95	94	93	92	72	--	26	18	34	16	2.70	18.0	7.8	1.7
B22ca----16 to 24	A-6 (11)	CL	0	100	100	100	99	98	95	76	--	34	27	31	17	2.68	15.0	8.5	1.8
Mobeetie fine sandy loam:[8] (S76TX-359-005)																			
A1------- 0 to 9	A-2-4(00)	SM-SC	0	100	100	99	97	96	94	26	--	8	7	20	4	2.67	16.0	2.3	1.8
B2------- 9 to 25	A-2-4(00)	SM-SC	0	100	100	99	98	97	94	30	--	13	11	21	6	2.64	15.0	3.5	1.8

See footnotes at end of table.

TABLE 19.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]											Liquid limit[2]	Plasticity index[2]	Moisture density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--							Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Posey clay loam:[9] (S76TX-359-006)																			
A1------- 0 to 6	A-6 (16)	CL	0	100	100	100	100	99	98	90	--	47	37	35	18	2.68	15.0	9.8	1.8
B21ca---- 6 to 18	A-6 (14)	CL	0	100	100	100	99	98	97	78	--	53	44	35	20	2.68	15.0	10.0	1.8
B22tca---18 to 36	A-6 (19)	CL	0	100	100	98	94	90	88	81	--	45	36	40	25	2.69	15.0	12.0	1.8
Montoya clay:[10] (S76TX-359-007)																			
A12------ 3 to 16	A-7-6(28)	CL	0	100	100	100	100	100	100	96	--	51	42	44	28	2.72	15.0	13.8	1.9
C2-------38 to 60	A-6 (19)	CL	0	100	100	99	99	98	98	97	--	50	44	36	19	2.82	15.0	10.6	1.9
Tascosa very gravelly sandy loam:[11] (S76TX-359-008)																			
A1------- 0 to 8	A-2-6(00)	GW-GC	5	100	67	56	41	29	18	12	--	4	3	35	16	2.65	19.0	8.0	1.7
C2-------28 to 60	A-2-4(00)	GW-GC	3	100	79	59	50	42	21	9	--	4	2	21	8	2.67	15.0	3.7	1.9
Clairemont silty clay loam:[12] (S76TX-359-009)																			
C1------- 9 to 19	A-6 (12)	CL	0	100	100	100	100	100	100	93	--	30	21	30	14	2.70	17.0	7.3	1.8
C2-------19 to 37	A-6 (09)	CL	0	100	100	100	100	100	100	87	--	30	20	28	12	2.68	16.0	6.8	1.8

[1] For soil materials larger than 3/8 inch, square mesh wire sieves are used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2] Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3] Veal loam:
2.0 miles north of Vega on U.S. Highway 385, 4.2 miles northeast on company road, 400 feet east.

[4] Pullman clay loam:
4.9 miles south of Adrian on Texas Highway 290, 100 feet east in a borrow pit.

[5] Olton clay loam:
200 feet southwest of junction of Texas Highway 214 and Interstate Highway 40 in Adrian.

[6] Berda clay loam:
3.8 miles north of Interstate Highway 40 in Vega on U.S. Highway 385 and 3,400 feet northwest.

[7] Quay silty clay loam:
18.5 miles west of Adrian on Interstate 40, 3.5 miles north, and 100 feet east of ranch road.

[8] Mobeetie fine sandy loam:
6.4 miles west of Texas Highway 290 in Adrian on Interstate Highway 40, 3,200 feet north.

[9] Posey clay loam:
2.9 miles west of Texas Highway 290 in Adrian on Interstate 40, 1,600 feet south.

[10] Montoya clay:
18.1 miles west of Texas Highway 290 in Adrian on Interstate Highway 40, 3,000 feet north.

[11] Tascosa very gravelly sandy loam:
From junction of U.S. Highway 385 and Farm Road 1061, 2.25 miles south, and 0.4 mile east in a gravel pit.

[12] Clairemont silty clay loam:
From junction of Farm Road 1061 and U.S. Highway 385, 3.3 miles east, and 300 feet north.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Acuff	Fine-loamy, mixed, thermic Aridic Paleustolls
Amarillo	Fine-loamy, mixed, thermic Aridic Paleustalfs
Berda	Fine-loamy, mixed, thermic Aridic Ustochrepts
Bippus	Fine-loamy, mixed, thermic Cumulic Haplustolls
Burson	Loamy, mixed (calcareous), thermic, shallow Ustic Torriorthents
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Estacado	Fine-loamy, mixed, thermic Calciorthidic Paleustolls
Glenrio	Clayey, mixed, thermic, shallow Ustochreptic Camborthids
*Gracemore	Sandy, mixed, thermic Aquic Udifluvents
Knoco	Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents
Latom	Loamy, mixed (calcareous), thermic Lithic Ustic Torriorthents
Likes	Mixed, thermic Typic Ustipsamments
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Lipan	Fine, montmorillonitic, thermic Entic Pellusterts
Lofton	Fine, mixed, thermic Vertic Argiustolls
Mobeetie	Coarse-loamy, mixed, thermic Aridic Ustochrepts
Montoya	Fine, mixed, thermic Mollic Torrerts
Olton	Fine, mixed, thermic Aridic Paleustolls
Posey	Fine-loamy, mixed, thermic Calciorthidic Paleustalfs
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
Pullman	Fine, mixed, thermic Torrertic Paleustolls
Quay	Fine-silty, mixed, thermic Ustochreptic Calciorthids
Randall	Fine, montmorillonitic, thermic Udic Pellusterts
Springer	Coarse-loamy, mixed, thermic Udic Paleustalfs
Spur	Fine-loamy, mixed, thermic Fluventic Haplustolls
Tascosa	Loamy-skeletal, mixed, thermic Aridic Calciustolls
Tivoli	Mixed, thermic Typic Ustipsamments
Veal	Fine-loamy, carbonatic, thermic Aridic Ustochrepts
Yomont	Coarse-silty, mixed (calcareous), thermic Typic Ustifluvents

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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