United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation
with Texas
Agricultural
Experiment
Station

Soil Survey of King County, Texas

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

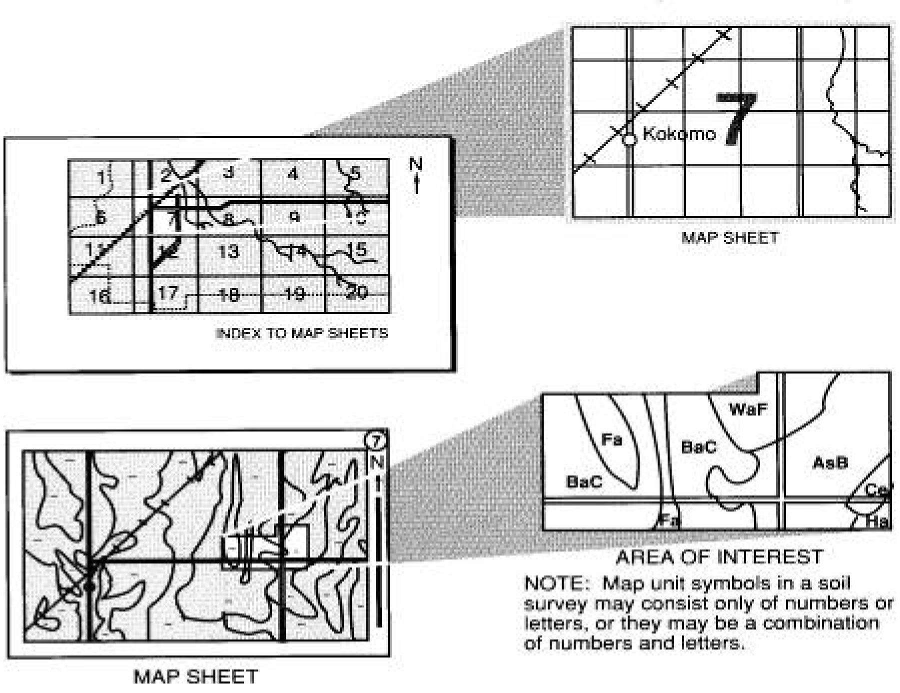
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and go to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

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 Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1997. Soil names and descriptions were approved in 1998. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1997. This survey was made cooperatively by the Natural Resources Conservation Service, and the Texas Agricultural Experiment Station. The survey is part of the technical assistance furnished to the King County Soil and Water Conservation District. The most current official data are available at **http://websoilsurvey.nrcs.usda.gov/app/**

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: A typical landscape on one of the large ranches in King County. Ninety percent of the county is rangeland, and livestock production provides the majority of all agricultural income.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov

Contents

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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 ensure 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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 Natural Resources Conservation Service or Texas Cooperative Extension.

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Soil Survey of King County, Texas

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

King County is located in north-central Texas (fig. 1). The total area is 584,948 acres, or about 914 square miles. Guthrie is the county seat of King County. It is located about 90 miles east of Lubbock and about 30 miles south of Paducah. Guthrie is crossed by the east-west U.S. Highway 82 and the north-south U.S. Highway 83. The small farming community of Dumont is located in the northwest part of the county.

King County is bordered on the north by Cottle and Foard Counties; on the south by Stonewall County; on the east by Knox County; and on the west by Dickens County.

The majority of the county lies within the Central Rolling Red Plains (Western Part) Major Land Resource Area (MLRA). The southeastern part of the county lies in the Central Rolling Red Plains (Eastern Part) MLRA (USDA, 1981). The main geological formations are of the Permian system, which includes the Whitehorse Formation to the west and the Blaine Formation to the east. Quaternary age outwash of ancient alluvium overlies a small part of these formations. These systems have provided an assortment of parent materials from which soils have formed. These include loamy and sandy alluvial deposits, dolomite, shales and clays, gypsum, and soft sandstones.

There are 35 soils identified in King County. Nearly all of the soils formed under and supported native grasses. The soils range widely in texture, color, depth, natural drainage, and other characteristics. Slope, depth to bedrock, natural fertility, and the hazard of flooding influence agriculture and urban uses.

Physiographically, the county was once covered by ancient alluvial outwash deposits. This outwash consisted of sandy, loamy, and clayey materials containing quartzite and chert gravels. Streams have since removed most of these old alluvial deposits and dissected the area. The nearly level and very gently sloping Frankirk, Kingco, and Westill soils are on many of the interstream divides. The divides are remnants of ancient alluvial deposits. The surface of some of the Permian age Knoco, Vernon, Talpa, and Cottonwood soils is covered with scattered lag gravels of quartzite and chert. The gravels are evidence of former outwash deposits that no longer exist.

Most of the hills and escarpments in the eastern part of the county have resulted from geological erosion of the alternating clay and shale beds around the more resistant dolomite and gypsum strata. In some mesa-like areas, layers of nearly level to gently sloping dolomite deposits are underlain by beds of gypsum. These areas have developed karst topography. Some of the sinks hold water following heavy rains, but most drain underground and emerge as gypsum-laden springs.

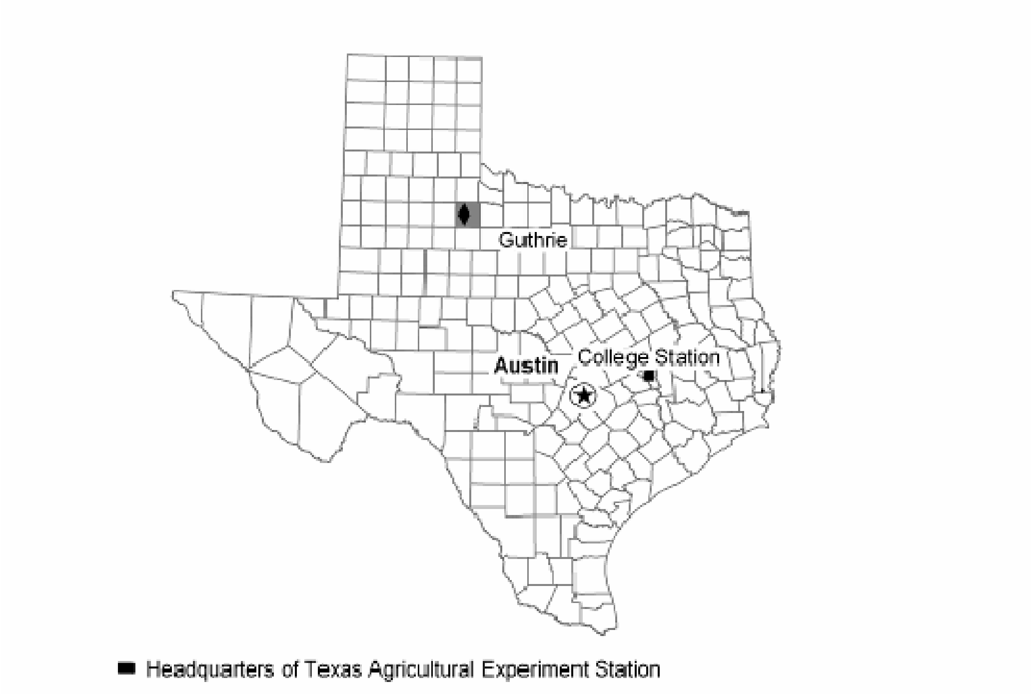

Figure 1.—Location of King County, Texas.

The elevation ranges from about 1,500 feet to about 2,175 feet above sea level with a general dip to the east. The county has drainage to two major river basins. A small portion of the southeast corner drains to the Brazos River. The rest of the county is drained by several forks of the Wichita River, all of which flow to the Red River. Nearly all the tributaries of these rivers are deeply entrenched.

General Nature of the Survey Area

This section gives general information about King County. It discusses settlement and population, natural resources, agriculture, and climate.

Settlement and Population

Isom Lynn was the first settler to take permanent residence in King County. He arrived in 1877 and lived east of Guthrie. By 1870, major conflicts with the Comanche and Kiowa Indians had ended; however, conflicts were a constant threat until about 1880. When Lynn arrived, the rolling prairies had abundant grasses with few trees and little brush. The highly productive, very deep soils supported tall prairie grasses, and the shallow soils supported mid and tall grasses. Hackberry, elm, western soapberry, cottonwood, and wild plum trees lined the creek channels.

Buffalo hide hunters found the area to be a favorable hunting ground for buffalo until the buffalo were depleted by 1875. Hide hunters left the prairies covered with piles of bleached buffalo bones. By 1882 only a few buffalo remained. Deer, antelope, turkey, quail, rattlesnakes, prairie chicken, and prairie dogs were abundant. Black bear, lobo wolves, porcupine, and mountain lion were also present. Today, the wallows of the buffalo are still visible in certain places.

More settlers and ranchers arrived and took up permanent residence. In 1878 and 1879, an open pit copper mine was worked near the Knox County line. By 1890, the population had reached 173. From 1876 to 1891, King County was attached to Baylor County. All legal government was carried out at Seymour, the county seat of Baylor

County. In 1891, King County was organized and permanent boundaries were established. By popular vote, Guthrie was elected to be the county seat. King County was named in honor of William P. King, a volunteer from Gonzales who died at the Alamo.

During the 1880's, open range came to an end as established ranchers and settlers began using barbed wire to fence their property. Buffalo bones were gathered and hauled to nearby markets. The bones were traded for lumber and other supplies. Providing dependable year-round water for livestock was a serious problem. Small ponds were dug by using slips and fresnos; although, they often went dry during periods of drought. By 1890, several windmills with large wooden wheels were used to pump gypsum-laden water for livestock. Deer, antelope, and prairie dogs fed on the settlers' crops of corn, sorghums, cotton, small grains, melons, and peaches. Predation by lobo wolves was a problem for ranchers, but by 1900 most of these animals were exterminated.

Oil production began in 1943 and continues through the present. Through the years, mesquite and redberry juniper have invaded the rangeland.

The population steadily increased from 1890 to 1930 when the population peaked at 1,193. In 1940, the county had 1,066 residents, and by 1990 the population had decreased to 364, of which 140 lived in Guthrie.

Natural Resources

Productive soils are the most important natural resource in the county. The Quaternary age terrace deposits near the North Fork of the Wichita River provide a source of irrigation water. Also present in the county are small deposits of gravel, which are suitable for road material. The production of cattle, wildlife, cotton, small grains, sorghums, old world bluestem, weeping lovegrass, and native grasses contributes a significant amount to the landowners' livelihood. Gypsum caverns as much as 300 feet below ground level provide a source of water for livestock. This water contains large amounts of dissolved salts and is only marginally suited to this use. Numerous ponds throughout the county provide water for livestock and recreation.

Large amounts of oil and gas are produced from numerous wells throughout the county. These wells provide an additional source of income to landowners as well as jobs for the people that drill and service the wells.

Wildlife produced on the farms and ranches provide recreation and a source of income for many residents. Deer, turkey, quail, dove, and feral hogs are plentiful throughout the county wherever cover is adequate.

The Blaine Formation contains many thick beds of gypsum and dolomite. These deposits are large enough to be worked, but mining is not thought to be economical at present.

Agriculture

King County is agriculturally oriented. Approximately 90 percent of the land area is used as rangeland. Most of the county agricultural income is derived from the sale of livestock. Livestock operations are primarily cow-calf. The 1997 Census of Agriculture inventoried about 23,000 head of cows and calves in the county (USDA, 1997). Some of the ranches use stocker calves to graze rangeland during the warm season and small grain forage during the cool season. Supplemental feeding of range cattle is generally needed from December through mid March. Horses are used to work cattle on most of the ranches. Many prized quarter horses are raised in the county.

At present, less than 4 percent of the land area in King County is cultivated. Cotton, the main crop, is being replaced by small grains for cool-season grazing. Forage sorghums are commonly grown for hay and supplemental grazing. Most of the cropland that is not presently cultivated has been seeded to introduced pasture grasses or native grasses for use as hayland, rotational grazing, or conservation reserve.

The total number of farms and ranches is decreasing because smaller farms and ranches have consolidated into larger commercial units. The number of farmed acres is also decreasing. Economics, intermittent droughts, highly erosive soils, and occasional hail storms are some of the contributing factors.

Climate

Table 1 provides data on temperature and precipitation for the survey area as recorded at Guthrie in the period 1971 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 42 degrees F and the average daily minimum temperature is 27 degrees. The lowest temperature on record, which occurred at Guthrie on December 23, 1989, is -10 degrees. In summer, the average temperature is 81 degrees and the average daily maximum temperature is 95 degrees. The highest temperature, which occurred at Guthrie on June 28, 1994, is 119 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 average annual total precipitation is about 25 inches. Of this, about 19 inches, or 76 percent, usually falls in April through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 8.85 inches at Guthrie on July 4, 1986. Thunderstorms occur on about 49 days each year, and most occur in May.

The average seasonal snowfall is 5 inches. The greatest snow depth at any one time during the period of record was 10 inches recorded on March 16, 1969, which was also the heaviest 1-day snowfall (10 inches) on record. On an average, 3 days per year have at least 1 inch of snow on the ground.

The average relative humidity in mid-afternoon is about 51 percent. Humidity is higher at night, and the average at dawn is about 82 percent. The sun shines 82 percent of the time in summer and 64 percent in winter. The prevailing wind is from the south-southeast. Average wind speed is highest, 12.8 miles per hour, in April.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map 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, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another 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.

1. Talpa-Knoco

Very shallow and shallow, very gently sloping to steep, well drained, loamy and clayey soils that formed in materials weathered from limestone and shale

This map unit consists of very gently sloping to steep soils on uplands. Slopes range from 1 to 30 percent.

This unit makes up about 29 percent of the county. It is about 34 percent Talpa soils, about 14 percent Knoco soils, and 52 percent other soils (fig. 2 and fig. 3).

Talpa soils are on ridges and side slopes on convex uplands. These soils are very shallow and shallow, gently sloping to steep, and well drained. Typically, the Talpa soils have a surface layer of brown gravelly loam. The subsurface layer is brown gravelly loam. The underlying material is dolomitic limestone.

Knoco soils are on side slopes on convex uplands. These soils are very shallow and shallow, gently sloping to steep, and well drained. Typically, the Knoco soils have a reddish brown clay surface layer. There are boulders on the surface of the soil. The underlying material is slightly weathered red shale with clay texture interbedded with light olive gray claystone.

Of minor extent are the well drained Cottonwood, Foursixes, Jaywi, Quanah, Tilvern, Vernon, and Westill soils on uplands. The well drained Wheatwood and Yomont soils are on flood plains. Areas of Badland and Rock outcrop are scattered throughout the area.

Areas of this map unit are used almost entirely as native range. The annual production of short and mid grasses is variable depending on annual rainfall and competition from brush. In most areas the competition from redberry juniper and mesquite is severe. The major management concerns are controlling brush and weeds, protecting grasses from overgrazing, and providing an adequate water supply for livestock.

Areas of this map unit are excellent for providing cover, food, and nesting materials for many songbirds, turkey, quail, dove, rabbits, feral hogs, coyotes, bobcats, raccoons, deer, and an occasional mountain lion. Much of the choice browse for deer is grown on the Talpa soils.

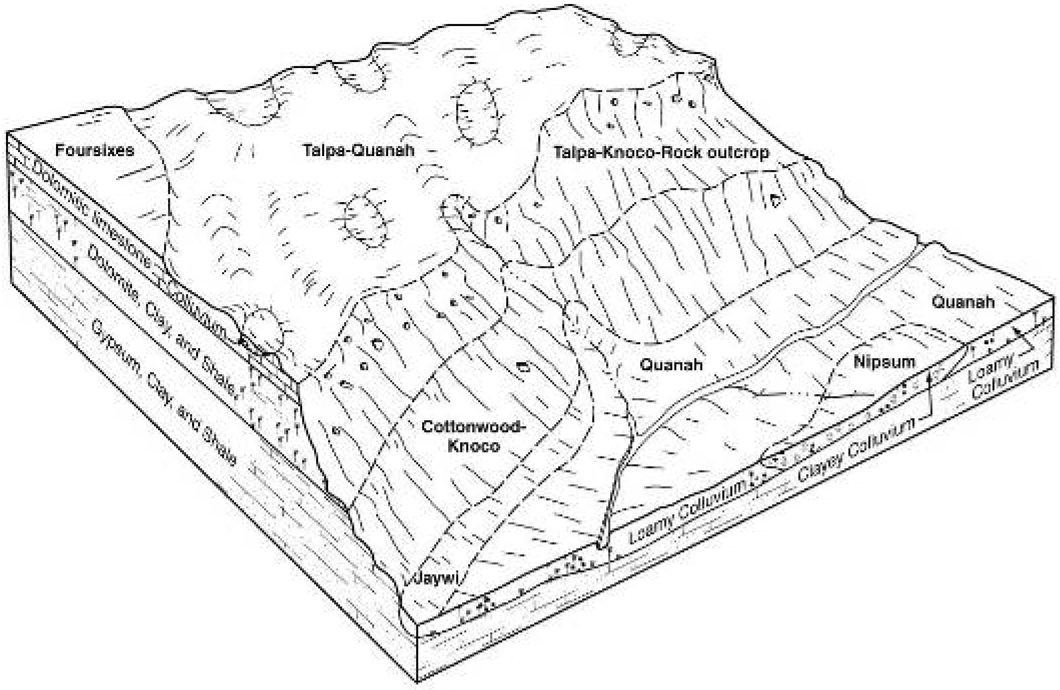

Figure 2.—Typical pattern of the Talpa-Knoco and the Cottonwood-Knoco general soil map units.

These soils have very low potential for cultivated crops because of the shallow depth to bedrock, boulders, and steep slopes. The potential is also low for most pond reservoir sites, sanitary facilities, building sites, and recreational uses. Slope, depth to bedrock, soil slippage, clay textures, rock outcrops, and boulders are the main limitations.

2. Cottonwood-Knoco

Very shallow and shallow, gently sloping to steep, well drained, loamy soils that formed in materials weathered from gypsum and shale

This map unit consists of gently sloping to steep soils on uplands. Slopes range from 3 to 45 percent.

This unit makes up about 22 percent of the county. It is about 32 percent Cottonwood soils, about 19 percent Knoco soils, and about 49 percent other soils (fig. 2).

Cottonwood soils are on ridges and side slopes on convex uplands. These soils are very shallow and shallow, gently sloping to steep, and well drained. Typically, the Cottonwood soils have a surface layer of light brown loam. The underlying material is slightly weathered light gray and white gypsum.

Knoco soils are on side slopes on convex uplands. These soils are very shallow and shallow, gently sloping to steep, and well drained. Typically, the Knoco soils have a surface layer of reddish brown clay. The underlying material is interbedded red and light gray shale with clay texture and noncemented claystone.

Of minor extent are the well drained Jaywi, Quanah, Talpa, and Tilvern soils on uplands. The very deep Nipsum soils are in valleys or on stream terraces. The well drained Wheatwood and Yomont soils are on flood plains. Areas of Badland and Rock outcrop are common throughout the area.

Areas of this map unit are used as rangeland. Short and mid grasses occur throughout most of the area; however, tall grasses exist where livestock accessibility is limited. Redberry juniper and mesquite thrive throughout this area. The major management concerns are controlling brush and weeds, protecting grasses from overgrazing, and providing an adequate water supply for livestock.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, feral hogs, quail, and dove. Many songbirds frequent the area for food, cover, and nesting.

This map unit has very low potential for cultivated crops because of the steep slopes and shallow depth to bedrock. The potential is also low for pond reservoir areas, sanitary facilities, building sites, and recreational uses. Slope, depth to bedrock, shrinking and swelling, clay texture, and gypsum that dissolves when saturated are the main limitations.

3. Woodward-Paducah-Carey

Moderately deep and very deep, nearly level to strongly sloping, well drained, loamy soils that formed in loamy material weathered from sandstone

This map unit consists mainly of nearly level to strongly sloping soils on uplands, but occasional moderately steep soils are on hills and above drainageways. Slopes range from 0 to 12 percent.

This map unit makes up about 18 percent of the county. It is about 39 percent Woodward soils, 27 percent Paducah soils, 8 percent Carey soils, and 26 percent soils of minor extent.

Woodward soils are on ridges and sideslopes on convex uplands. They are moderately deep, very gently sloping to strongly sloping, and well drained. Typically, the Woodward soils have a surface layer of reddish brown loam. The subsoil is yellowish red and red loam. The underlying material is noncemented sandstone.

Paducah soils are on concave ridges and footslopes. They are very deep, very gently sloping, and well drained. Typically, the Paducah soils have a surface layer of reddish brown loam. The upper part of the subsoil is reddish brown loam, the middle part is reddish brown and red clay loam, and the lower part is red loam. Below a depth of 62 inches the underlying material is light red noncemented sandstone.

Carey soils are on convex uplands. They are very deep, nearly level, and well drained. Typically, the Carey soils have a surface layer of brown and reddish brown loam. The subsoil is loam to a depth of 60 or more inches. It is reddish brown in the upper part and reddish yellow below. The underlying material is stratified light red very fine sandy loam and noncemented sandstone.

Of minor extent in this map unit are the well drained Enterprise, Obaro, Quinlan, St. Paul, and Shrewder soils on uplands. Westola and Yomont soils are on local flood plains.

This map unit is mostly used as rangeland; however, considerable acreage is used for growing cotton. Forage sorghums and small grains are also grown for pasture and hay. Tall grasses on rangeland have mostly been replaced by mid and short grasses. Mesquite is a common invader. Major management concerns are protecting cropped areas from wind and water erosion, controlling brush and weeds, protecting grasses from overgrazing, and maintaining soil structure and fertility.

Areas of this map unit are regularly inhabited by dove, quail, meadowlark, badgers, prairie dogs, gophers, and small reptiles. Only a few deer and turkey use the areas because of a lack of woody cover. The map unit provides an abundant supply of forbs and seeds. Small grains and sorghums provide additional feed for deer, turkey, and feral hogs.

Potential is high for sanitary facilities, building sites, and for most recreational uses. Slope is a limitation in some areas.

4. Woodward-Quinlan

Moderately deep and shallow, very gently sloping to very steep, well drained, loamy soils that formed in loamy material weathered from sandstone

This map unit consists mainly of very gently sloping to moderately steep soils on uplands, but occasional steep or very steep soils are along drainageways and areas of rock outcrop. Slopes range from 2 to 50 percent.

This map unit makes up about 15 percent of the county. It is about 48 percent Woodward soils, 22 percent Quinlan soils, and 30 percent soils of minor extent and rock outcrop.

Woodward soils are on ridges and side slopes on convex uplands. They are moderately deep, very gently sloping to strongly sloping, and well drained. Typically, the Woodward soils have a surface layer of reddish brown loam. The subsoil is yellowish red and red loam. The underlying material is noncemented sandstone.

Quinlan soils are on side slopes on convex uplands. They are shallow, moderately sloping to very steep, and well drained. Typically, the Quinlan soils have a surface layer of red very fine sandy loam. The subsoil is light red and red very fine sandy loam. The underlying material is noncemented sandstone.

Of minor extent in this map unit are the well drained Obaro, Paducah, and Shrewder soils on uplands. The well drained Yomont soils are on local flood plains. Rough broken land and Rock outcrop occur in some areas.

Most of this map unit is used for rangeland; however, a few scattered areas are used as cropland. The main crops are small grains for livestock grazing and forage sorghums for livestock grazing and hay. Most of the unit grows short and mid grasses. Tall grasses grow in areas where livestock accessibility is restricted. Mesquite has invaded most of this unit. The major management concerns are controlling brush, protecting the grasses from overgrazing, controlling soil erosion, and maintaining soil structure. Because of the low clay content in the soils of this unit, it is often difficult to build structures that will provide a dependable year-long supply of livestock water.

Areas of this map unit are used by turkey, quail, dove, and songbirds. A variety of smaller animals, such as prairie dogs, gophers, badgers, rabbits, and other small mammals also use this area. A few deer use the area, but browse is somewhat limited.

Potential is medium for sanitary facilities, building sites, and for most recreational uses. Depth to bedrock and slope are the main limitations.

5. Westill-Tilvern

Deep, nearly level and very gently sloping, well drained, loamy soils that formed in materials weathered from clay and shale

This map unit consists of areas of soils on smooth, broad uplands scattered throughout the eastern two-thirds of the county. Slopes range from 0 to 3 percent.

This map unit makes up about 11 percent of the county. It is about 39 percent Westill soils, 35 percent Tilvern soils, and 26 percent soils of minor extent (fig. 3).

Westill soils are on broad upland ridges and footslopes. They are deep, nearly level, and well drained. Typically, the Westill soils have a surface layer of reddish brown clay loam. The subsoil is reddish brown clay. The underlying material is stratified reddish brown and light olive brown mudstone.

Tilvern soils are on upland convex ridges and sideslopes. They are deep, very gently sloping, and well drained. Typically, the Tilvern soils have a surface layer of brown clay loam. The subsoil is reddish brown clay and silty clay. The underlying material is reddish brown weakly consolidated mudstone containing strata and mottles in shades of gray.

Of minor extent in this map unit are the well drained Cottonwood, Kingco, Knoco, Lazare, Talpa, and Vernon soils. Also included are areas of Badland-Knoco soils in

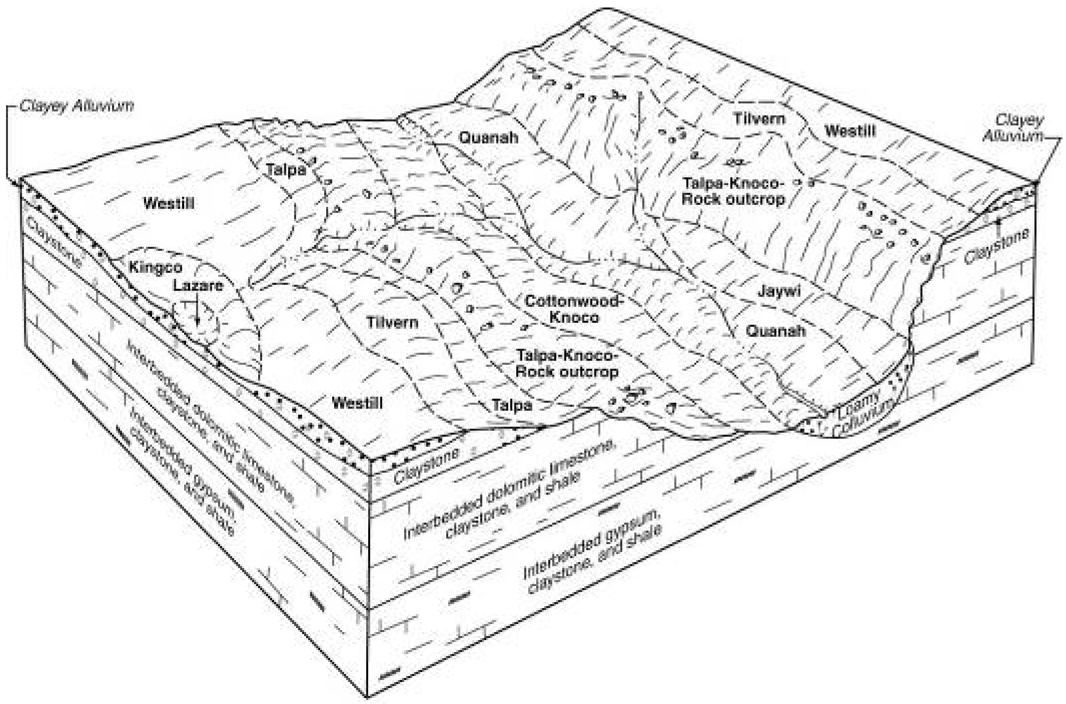

Figure 3.—Typical pattern of the Westill-Tilvern and the Talpa-Knoco general soil map units.

which the slopes are highly dissected by many small gullies and ravines. Small streams flow through the area.

Most of this map unit is used as rangeland; however, a few scattered areas are used as cropland. The main crops are small grains for cool-season pasture and forage sorghums for hay. Rangeland areas have short and midgrasses. All of the rangeland has been invaded by mesquite. Redberry juniper has invaded a few areas. The major management concerns are controlling water erosion, controlling brush and weeds, protecting the grasses from overgrazing, and maintaining soil structure and fertility.

Areas of this map unit furnish an abundance of forbs and other seed-and browse-producing plants that furnish excellent food for deer, turkey, feral hogs, rabbits, dove, and quail. Small grains help supplement the winter food supply.

Potential is medium for sanitary facilities, building sites, and for most recreational uses. Very slow permeability and shrinking and swelling of the clayey subsoil are the main limitations.

6. Grandfield-Shrewder-Devol

Very deep, nearly level to moderately sloping, well drained, sandy and loamy soils that formed in sandy and loamy deposits

This map unit consists mainly of nearly level to moderately sloping soils on upland stream terrace deposits. Slopes range from 0 to 8 percent.

This map unit makes up about 4 percent of the county. It is about 45 percent Grandfield soils, 9 percent Shrewder soils, 6 percent Devol soils, and 40 percent soils of minor extent (fig. 4).

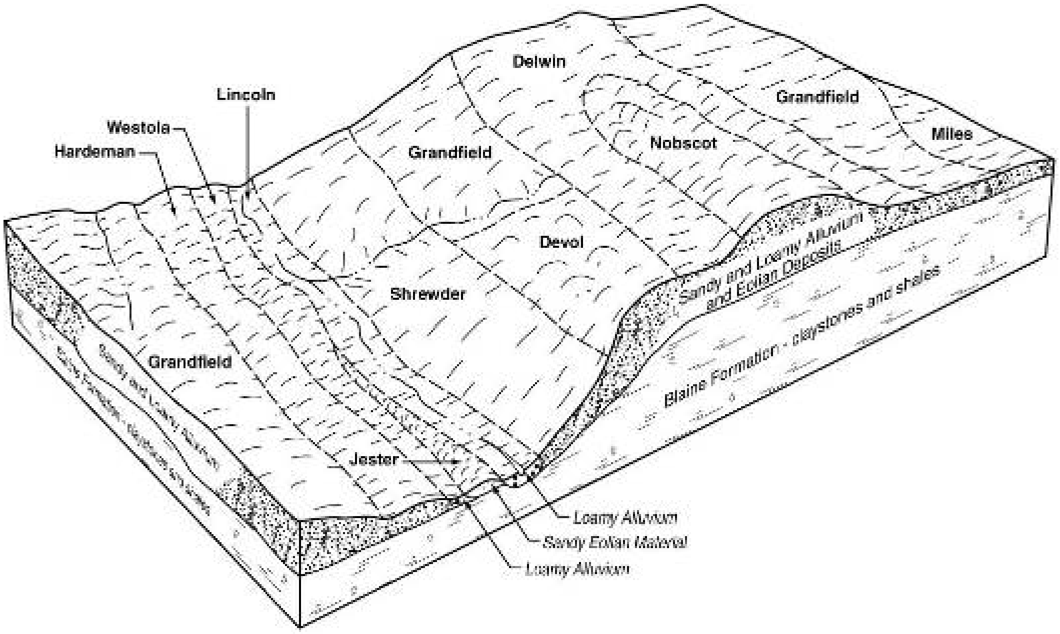

Figure 4.—Typical pattern of the Grandfield-Shrewder-Devol and the Delwin-Nobscot general soil map units.

Grandfield soils are on wide broad uplands generally at lower elevations than Devol soils. They are very deep, nearly level to gently sloping, and well drained. Typically, the Grandfield soils have a surface layer of reddish brown loamy sand or fine sandy loam. The subsoil is reddish brown or yellowish red sandy clay loam in the upper part and red sandy clay loam or fine sandy loam in the lower part.

Shrewder soils are at various elevations scattered throughout the map unit. They are very deep, gently sloping, and well drained. Typically, the Shrewder soils have a surface layer of reddish brown very fine sandy loam. The subsoil is reddish brown and red very fine sandy loam. The underlying material is light red very fine sandy loam that is underlain by light red soft stratified sandstone.

Devol soils are on convex, hummocky uplands, and side slopes. These soils are very deep, gently sloping to moderately sloping, and well drained. Typically, the Devol soils have a surface layer of brown loamy sand. The subsoil is yellowish red and brown sandy loam in the upper part and reddish yellow loamy sand in the lower part.

Of minor extent in this map unit are the well drained Carey, Enterprise, Frankirk, Hardeman, and Miles soils on uplands. The Jester soils are on dunes on flood plains. The Lincoln and Westola soils are on flood plains.

Most areas of this map unit are cultivated to cotton, small grains, sorghums, and peanuts. Common small scattered areas are used as rangeland. The major management concerns are controlling wind and water erosion, controlling brush and weeds, protecting the grasses from overgrazing, and maintaining soil structure and fertility.

The native vegetation provides good habitat for gamebirds, songbirds, and small furbearers. Scattered areas of mesquite provide good nesting and resting cover for birds. Narrow flood plains provide travel lanes and escape cover for coyote, deer, turkey, and feral hogs.

Potential is high for most sanitary facilities, building sites, and recreational uses. Sandy surfaces, slope, and seepage are the main limitations.

7. Delwin-Nobscot

Very deep, gently sloping, well drained, sandy soils on uplands

This map unit consists mainly of gently sloping soils on upland high terraces. Slopes range from 1 to 5 percent.

This map unit makes up about 1 percent of the county. It is about 54 percent Delwin soils, 34 percent Nobscot soils, and 12 percent soils of minor extent (fig. 4).

Delwin soils are on ridges and side slopes of convex uplands. They are very deep, gently sloping, and well drained. Typically, the Delwin soils have a surface layer of light reddish brown sand. The subsoil is reddish brown and yellowish red sandy clay loam.

Nobscot soils are on convex, hummocky uplands and side slopes. They are very deep, gently sloping, and well drained. Typically, the surface layer is yellowish brown and pink sand. The subsoil is red sandy loam in the upper part and light red and reddish yellow loamy sand containing lamellae in the lower part.

Of minor extent in this map unit are the well drained Devol and Grandfield soils on uplands and Westola and Wheatwood soils on flood plains.

Most of this map unit was once in cultivation. It is now mostly used for pasture and rangeland. Tall grasses grow in native areas where livestock accessibility is restricted. Shinnery oaks are also present in the native areas and fence rows. The major management concerns are managing the brush for wildlife, preventing soil erosion, maintaining soil structure and fertility, and controlling grazing.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and nesting sites. The unit is used by deer, feral hogs, small furbearers, gamebirds, and songbirds. Cover for protection is excellent.

Potential is generally high for most sanitary facilities and building sites; however, seepage is a limitation. Potential is low for most recreational sites because of the sandy surface layer.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, 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, slope, stoniness, salinity, 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, Grandfield loamy sand, 0 to 3 percent slopes, is a phase of the Grandfield series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Knoco-Vernon complex, 2 to 8 percent slopes, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other 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 or miscellaneous areas.

AcA—Acme loam, 0 to 1 percent slopes

This very deep, well drained, nearly level soil formed in loamy sediments that were once the beds of ancient lakes. These sediments contain high concentrations of gypsum. Most areas are in the western part of the county. Areas are irregular to oblong and range from 5 to 20 acres.

Typically, the surface layer is brown loam about 16 inches thick. The upper part of the subsoil is brown loam to a depth of about 25 inches. The middle part of the subsoil from 25 to 34 inches is mottled pink and light reddish brown gypsiferous loam that contains about 25 percent gypsum. The lower part of the subsoil from 34 to 80 inches is brown and pink gypsiferous loam that contains about 25 to 35 percent gypsum.

This Acme soil is high in natural fertility and organic matter content. The soil is calcareous throughout. The surface layer is slightly alkaline or moderately alkaline. The subsoil is moderately alkaline. Permeability is moderate, and surface runoff is negligible. The available water capacity is low. The soil has good tilth and can be worked throughout a fairly wide range of soil moisture conditions. A thick surface crust tends to form following heavy rains. Plant roots are slow to penetrate the gypsiferous lower part of the subsoil. The hazard of wind erosion is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are a few small areas of Acme soils that have greater than 1 percent slope. Also included are two other soils that are similar to the Acme soil; one is less than 10 inches deep to gypsiferous material and the other is more than 40 inches deep to gypsiferous material. The included soils make up less than 15 percent of the map unit with individual areas of the soils generally less than 4 acres.

Most areas of this Acme soil are used as rangeland. Very low water holding capacity in the gypsiferous subsoil layers limits forage production. Forage production can be maintained or improved by using proper stocking rates, rotation of grazing, and brush management. Brush management is practical and feasible on areas that have an excess growth of mesquite.

Several areas of this Acme soil are cultivated. Because of its low water holding capacity, the soil is mainly used for growing small grains for cool-season grazing. Minimum tillage and leaving crop residue on or near the soil surface help to prevent soil loss, improve water infiltration, and reduce surface crusting. Terraces and contour farming are needed to slow runoff and reduce water erosion in the included more sloping areas.

This soil is well suited to habitat for both openland wildlife and rangeland wildlife.

The Acme soil is in capability subclass 3s. It is in the Loamy ecological site.

AsC—Aspermont silty clay loam, 2 to 5 percent slopes

This deep, well drained, gently sloping soil is on upland convex ridges and footslopes. Areas are elongated to oval and range from 5 to 20 acres.

Typically, the surface layer is reddish brown silty clay loam about 6 inches thick. The subsoil is yellowish red silty clay loam to a depth of 33 inches and red silty clay loam to a depth of 45 inches. It has an accumulation of calcium carbonate between a depth of 22 and 45 inches. The underlying material is red slightly weathered clay with shale fragments to a depth of 56 inches. From 56 to 80 inches is reddish brown shale interbedded with layers of red silty clay loam.

The Aspermont soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is low. The available water capacity is moderate. Root development is restricted below a depth of 45 inches by mudstone material. This soil has good tilth and can be worked throughout a wide range of soil moisture. The hazard of water erosion and wind erosion is moderate.

Included with this soil in mapping are a few small areas of Quanah and Tilvern soils. The Quanah soils are on lower concave slopes and the Tilvern soils are on higher convex slopes. Included soils make up to 15 percent of the map unit, but individual areas of the soils are less than 8 acres.

Nearly all areas of this Aspermont soil are used as rangeland. Forage production on this soil is high where management is good. Overgrazing causes surface compaction, excessive runoff, erosion, and poor tilth. In many places close grazing and trampling have reduced the capacity of the soil to absorb water and have caused some areas to erode. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during prolonged dry periods help to keep the grasses and soil in good condition.

Few areas of this Aspermont soil are used for growing crops. Most areas are small or inaccessible or are surrounded by shallow soils. Other areas are dissected by deep drainageways. Some areas of this soil have potential for growing wheat and sorghums.

Lack of adequate moisture during the growing season is a limitation. If cultivated crops are grown, extensive measures are needed to control or prevent damage from wind and water erosion. Minimum tillage, winter cover crops, terracing and contour farming, and grassed waterways help to reduce runoff and erosion. Returning crop residue to the soil helps to maintain organic matter, improve fertility, reduce crusting, and increase water infiltration.

This soil is well suited to habitat for openland and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Loamy ecological site.

BKF—Badland-Knoco complex, 2 to 20 percent slopes

This complex consists of areas of Badland and very shallow and shallow, well drained Knoco soils. The landscape consists of geologically eroded, very gently sloping to moderately steep low knobs and raw escarpments that are backwearing into the surrounding uplands. The Badland is on escarpments, raw knobs, and where the bedrock is exposed on erosional flats. The Knoco soils are on narrow ridges and broad erosional flats. Individual areas of Badland and the Knoco soils are so intermingled or so small that to separate them at the selected scale for mapping was not practical. Areas are irregular in shape and range from 8 to 1,500 acres.

Badland makes up about 59 percent of the map unit. Typically, Badland consists of very gently sloping to moderately steep barren land. Geologic erosion is actively cutting the barren exposed red clay beds, claystone, shales, and gypsiferous shales of Permian age. Deeply entrenched active gullies are common.

Badland materials are low in natural fertility and organic matter content. They are moderately alkaline and calcareous. Permeability is very slow, and surface runoff is very high. The available water capacity is low. Badland is a constant source of large amounts of silty and clayey sediment and salts. The very shallow root zone greatly restricts the establishment of most plants. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

Knoco soils make up 25 percent of the map unit. Typically, they have a surface layer of reddish brown clay about 6 inches thick. The next layer, from a depth of 6 to 13 inches, is reddish brown clay containing fragments of claystone. The underlying material from 13 to 80 inches is dense red clay containing fragments and strata of light olive gray and red claystone.

Knoco soils are low in natural fertility and organic matter content. They are slightly alkaline or moderately alkaline and calcareous throughout. Permeability is very slow, and surface runoff is very high. The available water capacity is very low. Rooting is restricted to a depth of about 13 inches because of the dense clayey layer. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

Included with this complex in mapping are a few areas of moderately deep Vernon soils on remnants of ridges and footslopes that have not been eroded. Most drainageways are narrow and contain 2 to 3 feet of overwash consisting of stratified clays, clay loams, and weathered shale fragments. Also included throughout mapped areas are small bands of outcrops of gypsum and very shallow and shallow Cottonwood soils that have weathered from the gypsiferous material. The included soils and outcrops make up about 16 percent of the map unit, but individual areas are less than 10 acres.

This complex is used as rangeland. Most of the forage is produced on this unit during the spring season. Plant composition and vigor can be maintained or improved and erosion slowed by controlling weeds and brush and limiting grazing to the cool-season grasses.

This complex is not suited to cultivated crops. It is poorly suited for producing habitat for openland and rangeland wildlife.

The Badland component is in capability subclass 8e, and is not assigned an ecological site. The Knoco soil is in capability subclass 7s, and is in the Very Shallow Clay ecological site.

BmA—Beckman clay, 0 to 1 percent slopes, frequently flooded

This very deep, moderately well drained, nearly level soil is on flood plains. This soil is very briefly flooded 5 or more times within a 10-year period. Its salinity levels are affected by salts from recently deposited sediments. Areas are long and narrow along stream channels and range from 5 to 25 acres.

Typically, the surface layer is reddish brown clay about 8 inches thick. The subsoil is clay to a depth of 58 inches and contains common concretions and crystals of salt. The underlying material to a depth of 77 inches is reddish brown clay containing thin loamy strata and many salt crystals.

The Beckman soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is very slow, and surface runoff is high. The available water capacity is moderate. Root development is restricted because of the dense clay and excess salt content. The hazard of wind erosion is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are a few small areas of Wheatwood soils along stream channels. A few areas have a surface layer of clay loam, and parts of some areas are only occasionally flooded because of deeply incised stream channels. The included soils make up about 10 percent of the map unit, but individual areas are generally less than 5 acres.

This Beckman soil is used entirely as rangeland. Production of native forages is limited by the slightly and moderately saline clay at shallow and moderate depths.

Overgrazing when the soil is too wet or too dry causes surface compaction, reduces water infiltration, and causes a loss of plant vigor allowing brush to invade and thicken. Brush management is practical and feasible on areas that have an excess growth of mesquite.

This soil is poorly suited to use as cropland. The excess salt content is sufficiently high to reduce yields. The frequent flooding is a limitation that is difficult to overcome.

The soil is poorly suited to habitat for openland wildlife and rangeland wildlife.

This Beckman soil is in capability subclass 5w. It is in the Saline Bottomland ecological site.

CaA—Carey loam, 0 to 1 percent slopes

This very deep, well drained, nearly level soil is on convex uplands. Areas are oval and range from 10 to 100 acres.

Typically, the surface layer is dark brown and reddish brown loam to a depth of about 16 inches. The subsoil is loam to a depth of 66 inches. It is reddish brown in the upper part and reddish yellow below. The underlying material from 66 to 80 inches is light red, stratified very fine sandy loam and noncemented sandstone.

The Carey soil has high natural fertility and organic matter. The surface layer is neutral or slightly alkaline. The subsoil is neutral to moderately alkaline in the upper part and is moderately alkaline below. Permeability is moderate, and surface runoff is negligible. The available water capacity is high. The surface layer is friable and is easily tilled throughout a wide range of moisture conditions. The soil surface tends to crust or puddle following hard rains. The root zone is very deep, and root development is not restricted to a depth of 60 inches or more. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included with this soil in mapping are a few areas of the closely similar Paducah soils on upper slopes and St. Paul soils in slightly depressional areas. The included soils make up about 10 percent of the map unit, but individual areas of the soils are less than 8 acres. In some map units, the slope slightly exceeds 1 percent.

Many areas of this Carey soil are cultivated and used for growing cotton. This soil is also well suited to alfalfa, wheat, grain sorghums, and forage sorghums. Minimum tillage, winter cover crops, strip cropping, and windbreaks help to reduce erosion. Leaving crop residue on or near the surface helps to improve fertility, maintain organic matter, reduce crusting, and improve infiltration.

Many areas of this soil are used as rangeland. The high natural fertility and available water capacity allow maximum production of good quality native plants. This soil is highly preferred by grazing animals, and good management is necessary to minimize overgrazing.

The soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 2c. It is in the Loamy Prairie ecological site.

CKF—Cottonwood-Knoco complex, 3 to 20 percent slopes

This complex consists of very shallow and shallow, well drained Cottonwood and Knoco soils on uplands (fig. 5). Areas consist of interbedded layers of gypsum, claystone, and clay that form steep scarps and step-like benches. Areas are dissected by many intermittent streams and gullies. The Cottonwood soils are gently sloping to moderately steep and are on narrow ridges, scarps, and benches. They formed in material weathered from gypsum. The Knoco soils are gently sloping to moderately steep and are on side slopes between layers of gypsum. They formed in material weathered from calcareous clay and claystone. Erosion is active in most areas and about 5 to 10 percent of the underlying geological formations are exposed. Individual

Figure 5.—This small creek dissects an area of Cottonwood-Knoco complex, 3 to 20 percent slopes and is used for a pond site. Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes, occurs in the background.

areas of these soils are so intermingled or so small that it was not practical to separate them at the scale used for mapping.

Slopes are mostly 3 to 20 percent; however, some ridgetops are less sloping and some narrow areas along drainageways slope as much as 40 percent. Areas of this complex are in the eastern part of the county. They are irregular in shape and range from 20 to 2,500 acres.

The Cottonwood soils make up about 55 percent of the map unit. Typically, the surface layer is light brown loam to a depth of 12 inches. The underlying material to a depth of 20 inches is light gray to white gypsum bedrock. It is slightly weathered in the upper 3 inches.

Cottonwood soils are low in natural fertility and organic matter content. They are moderately alkaline and calcareous. Permeability is moderate in the solum and slow in the gypsum. Runoff is very high. The available water capacity is very low. Gypsum restricts rooting depth at about 5 inches. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

The Knoco soils make up about 30 percent of the map unit. Typically, the surface layer is reddish brown clay loam about 3 inches thick. From 3 to 12 inches is reddish brown clay. The underlying material is weathered, interbedded red and light gray claystone to a depth of 36 inches or more.

Knoco soils are low in natural fertility and organic matter content. They are moderately alkaline and calcareous throughout. Permeability is very slow, and runoff is very high. Available water capacity is very low. Rooting depth is restricted to very shallow and shallow depths by the dense clayey layer. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

Included with this complex in mapping are small areas of Aspermont, Talpa, and Rock outcrop. Narrow bands of loamy bottomland soils occur along some of the larger creeks or drains. The included soils and rock outcrop make up about 15 percent of the map unit, but individual areas of the soils and rock outcrop are generally less than 5 acres.

This complex is used as rangeland. Forage production is low because of low available water capacity, slope, and a restricted root zone. Forage grown on the Cottonwood soil is not as well preferred by livestock as the forage on the Knoco soil. Hence the small areas of Knoco soils are usually heavily grazed. Redberry juniper and mesquite have invaded nearly all areas.

The soils in this complex are not suited to cropland. The hazard of water erosion, rock outcrop, and slope limit this use.

The soils in this complex are poorly suited to producing habitat for openland and rangeland wildlife.

This complex is in capability subclass 7s. The Cottonwood soils are in the Gyp ecological site and the Knoco soils are in the Very Shallow Clay ecological site.

DeC—Delwin sand, 1 to 5 percent slopes

This very deep, well drained, gently sloping soil is on convex ridgetops and side slopes on uplands. Areas are irregular in shape and range from 15 to 900 acres.

Typically, the surface layer is light reddish brown sand to a depth of about 17 inches. The subsoil from a depth of 17 to 80 inches is sandy clay loam. It is reddish brown in the upper part, yellowish red in the middle part, and reddish yellow in the lower part.

The Delwin soil has low natural fertility and organic matter content. The surface layer is slightly acid or neutral, and the subsoil is neutral to moderately alkaline. Permeability is moderate, and runoff is low. The available water capacity is moderate. The surface layer is loose and easily tilled throughout a wide range of soil moisture conditions. Roots easily penetrate all layers of the soil. The hazard of water erosion is moderate and the hazard of wind erosion is severe.

Included with this soil in mapping are a few areas of Devol and Nobscot soils on ridgetops and Grandfield soils on steeper side slopes. Also included are sandy ridges 4 to 6 feet high and 30 to 60 feet wide that have been blown along fence rows and brushy areas. In a few small spots the sandy surface layer has been eroded away and the reddish subsoil is exposed. The included soils make up about 10 percent of the map unit, but individual areas of the soils are less than 8 acres.

Most areas of this Delwin soil were previously cultivated to cotton and sorghums, but presently most areas are in grass. The remaining cultivated acreage is used for growing cotton, sorghums, melons, and small grains for cool-season grazing. Low fertility and wind erosion commonly limit yields. Intensive conservation treatments are required to limit soil blowing. Stripcropping, minimum tillage, residue management, windbreaks, and winter cover crops help reduce wind erosion. The use of crop residues helps slow runoff and allows better soil moisture storage. The soil is well suited to growing trees as windbreaks.

Many previously cropped areas of this Delwin soil have been converted to rangeland. These old cropland areas are well suited to growing mid and tall native grasses. With good management practices, production is medium to high. Overgrazing during dry periods causes the grass stand to deteriorate and this increases the hazard of wind erosion. Weeds and poor quality annual grasses invade when the grass stand is thin. Proper stocking rates, restricted use during prolonged dry periods, and timely deferment and rotation of grazing help to keep the grasses and soil in good condition.

The soil is moderately suited to habitat for openland wildlife and is well suited to habitat for rangeland wildlife.

This soil is in capability subclass 4e. It is in the Sandy ecological site.

DvD—Devol loamy sand, 3 to 8 percent slopes

This very deep, well drained, gently sloping or moderately sloping soil is on hummocky upland convex ridges and side slopes. Areas are irregular in shape and range from 10 to 300 acres.

Typically, the surface layer is brown loamy sand about 17 inches thick. The subsoil is yellowish red and brown sandy loam to a depth of 43 inches. The underlying material is reddish yellow loamy sand to a depth of 80 inches.

The Devol soil has low natural fertility and organic matter content. The surface layer is neutral, and the subsoil is neutral to slightly alkaline. Permeability is moderately rapid, and surface runoff is low. The available water capacity is moderate. The surface layer is friable and can be worked throughout a wide range of soil moisture conditions. The root zone is easily penetrated by plant roots to a depth of 80 inches or more. The hazard of wind erosion is severe, and the hazard of water erosion is moderate.

Included with this soil in mapping are a few small areas of Grandfield soils in concave footslope positions and Nobscot and Shrewder soils in concave side slope positions. In some previously cultivated areas, erosion has removed most of the topsoil and subsoil and deposited deep sands along fence rows. The included soils make up as much as 15 percent of the map unit, but individual areas are less than 7 acres.

Most areas of this Devol soil are used as rangeland because of the severe wind erosion hazard and the rolling topography. If management is good, production of native grasses is medium. Overgrazing during dry periods causes the grass stand to deteriorate and increases the hazard of wind erosion. A decrease in the native grass stand allows brush, weeds, and poor quality annual grasses to invade. Proper stocking rates, restricted use during prolonged dry periods, and timely deferment and rotation of grazing help to keep the grasses and soil in good condition. The soil is well suited to growing trees as windbreaks. Supplemental moisture is generally required to establish young trees.

This soil is poorly suited to cultivated crops. Moderate available water capacity, short rolling slopes, and the hazard of severe wind erosion are difficult obstacles to overcome. Intensive conservation treatments are required. Minimum tillage, windbreaks, residue management, winter cover crops, and stripcropping help to reduce erosion losses.

The Devol soil is moderately suited to habitat for openland and rangeland wildlife.

This soil is in capability subclass 4e. It is in the Loamy Sand Prairie ecological site.

EnB—Enterprise very fine sandy loam, 1 to 3 percent slopes

This very deep, well drained, very gently sloping soil is on convex slopes on upland terraces. Generally the soil formed in eolian sediments blown from channels of streams. A few areas formed in ancient outwash deposits. Areas are elongated to oval and range from 10 to 120 acres.

Typically, the surface layer is yellowish red very fine sandy loam about 7 inches thick. The subsoil is very fine sandy loam to a depth of 70 inches. It is yellowish red in the upper part and red in the lower part. The underlying material to a depth of 84 inches is yellowish red very fine sandy loam containing strata of coarser material.

The Enterprise soil has medium natural fertility and organic matter content. The surface layer is slightly alkaline or moderately alkaline. The subsoil is slightly alkaline or moderately alkaline and calcareous. Permeability is moderately rapid, and surface runoff is very low. The available water capacity is high. The surface layer is friable and easily tilled throughout a wide range of soil moisture conditions. Root development is not restricted. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are small areas of Grandfield, Westola, and Woodward soils. Grandfield and Woodward soils are on higher convex ridges and edges of delineations. Westola soils are on lower edges within flood plains. Also included are a few areas that have slopes less than 1 percent and a few others that have slopes slightly more than 3 percent. The included soils make up less than 15 percent of the map unit, but individual areas of the soils are less than 4 acres.

Most areas of this Enterprise soil are used as rangeland. The soil absorbs water readily. If management is good, the production of native forages is high. Proper stocking rates, rotational grazing, and restricted use during prolonged dry periods help to keep the rangeland and soil in good condition.

Only a few areas of this Enterprise soil are cultivated. It is well suited to cultivation. Crops adapted to this soil include cotton, small grains, alfalfa, forage and grain sorghums, and peanuts. Production is limited by the lack of timely rainfall. Minimum tillage, winter cover crops, terracing, contour farming, and grassed waterways help reduce erosion. Windbreaks, residue management, and tillage that leaves a rough surface help protect the soil from wind erosion. There are no serious limitations for growing trees as windbreaks on this soil.

This Enterprise soil is well suited to habitat for openland and rangeland wildlife.

This soil is in capability subclass 2e. It is in the Sandy Loam ecological site.

EnC—Enterprise very fine sandy loam, 3 to 5 percent slopes

This very deep, well drained, gently sloping soil is on uplands. The soil formed in sediments above channels of large streams. Areas are oblong and range from 8 to 35 acres.

Typically, the surface layer is yellowish red very fine sandy loam about 20 inches thick. The subsoil is yellowish red very fine sandy loam to a depth of 42 inches. It contains films and threads of calcium carbonate. The underlying material to a depth of 80 inches is reddish yellow very fine sandy loam containing films and threads of calcium carbonate.

The Enterprise soil has medium natural fertility and organic matter content. The surface layer is slightly alkaline or moderately alkaline, and calcareous. The subsoil is slightly alkaline or moderately alkaline, and calcareous. Permeability is moderately rapid, and surface runoff is very low. The available water capacity is high. The surface layer is friable and easily tilled throughout a wide range of soil moisture conditions. Roots easily penetrate the soil to a depth of 80 inches or more. The hazard of wind erosion and water erosion is moderate.

Included with this soil in mapping are a few scattered small areas of Jester, Shrewder, and Woodward soils. In several mapped areas, portions of the map unit contain slopes slightly more than 5 percent. The included soils make up about 15 percent of the map unit, but individual areas of the soils are less than 5 acres.

Most all of this Enterprise soil is used as rangeland. If grazing is reasonably well managed, tall grasses grow well and develop deep root systems. Continued close grazing, however, causes the tall grasses to lose their vigor. Then short grasses and brush will replace them. Brush management along with deferred grazing hastens range improvement where there is an excessive growth of brush species and some climax grasses are still present.

This Enterprise soil is moderately suited to growing crops. Wheat, sorghums, and cotton are suited, but controlling erosion is a concern. Terraces, contour farming, residue management, and grassed waterways help reduce runoff and control erosion.

This soil is well suited to producing habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Sandy Loam ecological site.

FoA—Foursixes clay loam, 0 to 1 percent slopes

This moderately deep, well drained, nearly level soil is on uplands. This soil formed in dolomitic limestone. Areas are oval and range from 6 to 25 acres.

Typically, the surface layer is brown clay loam about 4 inches thick. The subsoil is reddish brown clay to a depth of 23 inches. The underlying material is indurated, light gray, coarsely fractured dolomitic limestone and noncemented mudstone.

The Foursixes soil has medium natural fertility and organic matter content. The surface layer is neutral or slightly alkaline. The subsoil is slightly alkaline or moderately alkaline in the upper part. The lower part of the subsoil is moderately alkaline and calcareous. Permeability is slow, and runoff is low. The available water capacity is low. The soil surface tends to crust or puddle following hard rains. Root development is restricted by the limestone bedrock at depths of about 20 to 40 inches. The hazard of wind erosion and water erosion is slight.

Included with this soil in mapping are a few small areas of Talpa soils along outer edges and other scattered spots where bedrock is near the surface. Also included is a soil similar to the Foursixes soil in which the soil is less than 20 inches thick to bedrock. The included soils make up about 20 percent of the map unit, but individual areas of the soils are less than 4 acres.

The soil is used as rangeland. Forage grown on this soil is highly preferred by grazing animals, and careful management is necessary to minimize overgrazing. Forage production is limited by the low water holding capacity of the soil. Because of continuous grazing, short grasses are now dominant. In many places close grazing and trampling have reduced the capacity of the soil to absorb water. Brush management is advantageous in areas that have an excessive growth of mesquite and other brushy vegetation.

This soil is moderately suited to cropland. Crops grown during the cool season are better adapted. The low water holding capacity and the clayey subsoil, which slows root growth, are limitations. Minimum tillage, winter cover crops, and residue management help prevent soil loss, improve fertility, reduce surface crusting, and increase water infiltration.

This soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

The soil is in capability subclass 3s. It is in the Clay Loam ecological site.

FrB—Frankirk loam, 0 to 2 percent slopes

This very deep, well drained, nearly level and very gently sloping soil is on broad, high upland stream terraces. Slopes are smooth and convex. Areas range from 10 to more than 100 acres.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil is reddish brown to a depth of 37 inches. It is clay loam in the upper part and clay in the lower part. From a depth of 37 to 56 inches the subsoil is yellowish red clay loam. Below, to a depth of 84 inches, is red sandy clay loam.

The Frankirk soil has high natural fertility and organic matter content. Reaction of the upper part of the soil is neutral, and the lower part is slightly alkaline. Permeability is moderately slow, and surface runoff is low to medium. The available water capacity is high. This soil has good tilth and can be worked throughout a fairly wide range of soil moisture conditions. The soil surface tends to crust or puddle following hard rains. The plant root zone is unrestricted; however, the clayey subsoil layer slows root penetration. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Included with this soil in mapping are a few small areas of Grandfield soils on or near low ridges. Westill soils occur on lower elevations. These included soils make up about 10 percent of the map unit, but individual areas of the soils are less than 5 acres.

Most areas of this Frankirk soil are used as rangeland. The forage grown on this soil is highly preferred by grazing animals, and careful management is necessary to prevent the loss of the desirable native plants. Where management is good, the high natural fertility and available water capacity favor maximum production of quality native forages. Brush management is advantageous in areas that have an excessive growth of mesquite or other brushy vegetation.

Some areas of this Frankirk soil are cultivated to cotton, wheat, and sorghums. This soil is well suited to this use. Rainfall during the growing season is often inadequate, and crop yields are reduced. Minimum tillage, winter cover crops, and residue management help prevent soil loss, improve fertility, reduce surface crusting, and increase water infiltration. Contour farming and terracing help control water erosion by slowing runoff and allowing more water to infiltrate the soil.

The soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 2e. It is in the Loamy Prairie ecological site.

GdB—Grandfield loamy sand, 0 to 3 percent slopes

This very deep, well drained, nearly level and very gently sloping soil is on upland ancient stream terraces. Areas are irregular in shape and range from 15 to 250 acres.

Typically, the surface layer is reddish brown loamy sand about 7 inches thick. The upper part of the subsoil from 7 to 32 inches is red sandy clay loam. From 32 to 51 inches the subsoil is yellowish red fine sandy loam. The lower part of the subsoil from 51 to 57 inches is yellowish red loamy sand. The underlying material is reddish yellow sand to a depth of 80 inches.

In this Grandfield soil, natural fertility is medium, and organic matter content is low. The surface layer and the upper part of the subsoil are neutral, and the middle part to lower part of the subsoil is slightly alkaline, increasing to moderately alkaline with depth. Permeability is moderate, and surface runoff is negligible to low. The available water capacity is moderate. The surface layer is loose and easily tilled throughout a wide range of soil moisture conditions. Plant roots easily penetrate all soil layers. The hazard of water erosion is moderate and the hazard of wind erosion is severe.

Included in mapping are small areas of Devol soils on mounded areas and ridges. A few areas of eroded Grandfield soils are also included. In these areas, erosion removed so much of the surface layer during periods of cultivation that the subsoil is now exposed and shallow gullies and rills are present. In other areas wind erosion has removed so much of the fine particles that the surface texture is now sand. Also included in some mapped areas are spots that have a slope as much as 4 percent. The included soils make up about 10 percent of the map unit, but individual areas of the soils are mostly less than 5 acres.

Most areas of this Grandfield soil were once cultivated, but many of these areas are now in grass. Areas used for cultivation are moderately suited to this use.

Commonly grown crops include cotton, wheat, and sorghums. Intense conservation measures are required to prevent blowing of the loose sandy surface layer. Minimum tillage, crop residue left on or near the surface, cover crops, contour farming, and terraces that empty into grassed waterways help prevent wind and water erosion. The soil is well suited to growing trees as windbreaks.

This Grandfield soil is mostly used as rangeland. Medium production of native forages can be obtained from well managed areas. The moderate available moisture capacity limits production in most years. In some areas controlling brush is advantageous, especially if some climax grasses are present and good management practices are followed. In areas where only low quality native grasses remain, a complete seedbed preparation followed by range seeding offer the best opportunity for range improvement.

Many local species of wildlife inhabit areas of this Grandfield soil. The tree-lined drainageways and windbreaks serve as cover and corridors for wildlife. The soil is moderately suited to developing and improving habitat for openland wildlife and is well suited to habitat for rangeland wildlife.

This soil is in capability subclass 3e. It is in the Loamy Sand Prairie ecological site.

GdC2—Grandfield loamy sand, 2 to 5 percent slopes, moderately eroded

This very deep, well drained, gently sloping soil is on convex eroded uplands. In many areas the subsoil is exposed on the surface or in the plow layer. Small crossable gullies are common along with an occasional uncrossable gully. Areas are irregular in shape and range from 8 to 40 acres.

Typically, the surface layer is light reddish brown loamy sand about 3 inches thick. The subsoil is sandy clay loam to a depth of about 55 inches. It is red in the upper part and light red in the lower part. From 55 to 80 inches is reddish yellow fine sandy loam.

This Grandfield soil is low in natural fertility and organic matter content. The surface layer and the upper part of the subsoil are neutral. The lower part of the subsoil is neutral grading to moderately alkaline. Permeability is moderate, and surface runoff is low. The available water capacity is moderate. The surface layer is loose and easily tilled throughout a fairly wide range of soil moisture conditions. In areas where the subsoil material is exposed, it tends to crust or puddle after hard rains. These areas generally have poor tilth and surface structure. Root development in this soil is not restricted to a depth of 80 inches or more. The hazards of wind erosion and water erosion are severe.

Included with this soil in mapping are a few small areas of the closely similar Delwin and Miles soils on lower, slightly concave slopes. Also included in concave areas and areas near fence rows are small spots of Grandfield soils that are not eroded. Some of the mapped areas have slopes slightly more than 6 percent. The included soils make up less than 15 percent of the map unit, but individual areas of the soils are less than 6 acres.

This soil has been used for cultivated crops, but now most of the areas have been seeded to grass. This soil is moderately suited to cultivated crops. Loss of the surface layer, low fertility, slope, and the severe hazards of erosion are difficult obstacles to overcome. Cotton, wheat, and sorghums can be grown if management is intensive. Minimum tillage, cover crops, terracing, stripcropping and contour farming, grassed waterways, and residue management help reduce additional loss of soil and conserve moisture. Extra fertilizer is needed to help overcome lost fertility. Windbreaks are well suited to this soil, but extra water is required for young tree establishment.

This Grandfield soil is mostly used as rangeland where formerly cropped areas have been seeded to grass. Grass production is medium if not too much of the subsoil is exposed. Establishing grass and maintaining a stand is difficult in areas where the surface layer has eroded away. Overgrazing during dry periods causes the stand to deteriorate and allows undesirable plant species to invade. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods help keep forages and soil in good condition.

This soil is moderately suited to habitat for openland wildlife and is well suited to habitat for rangeland wildlife.

This soil is in capability subclass 4e. It is in the Loamy Sand Prairie ecological site.

GfB—Grandfield fine sandy loam, 1 to 3 percent slopes

This very deep, well drained, very gently sloping soil is on upland high terrace outwash of Pleistocene age. Areas are oblong to elongated and range from 8 to 225 acres.

Typically, the surface layer is reddish brown fine sandy loam about 8 inches thick. The upper part of the subsoil from 8 to 38 inches is reddish brown grading to yellowish red sandy clay loam. The lower part of the subsoil from 38 to 80 inches is red fine sandy loam containing films and threads of calcium carbonate.

For this Grandfield soil natural fertility and organic matter content are medium. The surface layer is neutral or slightly alkaline. The subsoil is slightly alkaline or moderately alkaline. Permeability is moderate, and surface runoff is low. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a wide range of soil moisture conditions. The soil surface tends to crust or puddle following hard rains. Rooting depth is not restricted to a depth of 80 inches or more. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are small areas of Grandfield loamy sand and some eroded knolls that have exposed subsoils. The closely similar Miles soils occur in some concave areas. These soils make up less than 15 percent of the map unit, but individual areas of the soils are less than 5 acres.

About half of the areas of this soil are used as cropland. This soil is well suited to growing cotton, sorghums, and small grains. Controlling erosion is a major concern. Careful management is needed to prevent blowing sand from damaging emerging seedlings. Terraces, minimum tillage, winter cover crops, stripcropping, windbreaks, and farming on the contour help reduce erosion. Leaving crop residue on or near the surface helps improve fertility, maintain organic matter, reduce crusting, and improve infiltration.

The production of forage on this Grandfield soil is high if management is good. Care must be taken, however, to control stocking rates and time of grazing since the grass stand is easily damaged during periods of drought. Where there is an excessive growth of brush species and some climax grasses present, brush management along with deferred grazing help improve the rangeland.

This soil is well suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 2e. It is in the Sandy Loam ecological site.

GfC—Grandfield fine sandy loam, 3 to 5 percent slopes

This very deep, well drained, gently sloping soil is on convex side slopes below ridges. Areas are irregular in shape and range from 8 to 100 acres.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The upper part of the subsoil from 8 to 39 inches is sandy clay loam that is reddish brown grading to red. The lower part of the subsoil from 39 to 80 inches is red fine sandy loam that contains a few concretions and films of calcium carbonate.

This Grandfield soil has medium natural fertility and organic matter content. The surface layer is neutral, and the subsoil ranges from neutral in the upper part to moderately alkaline in the lower part. The surface layer is friable and is easily tilled throughout a wide range of soil moisture conditions. A thick crust forms on the surface following heavy rains. Permeability is moderate, and surface runoff is low. The available water capacity is moderate. Root development is not restricted, and plant roots penetrate to a depth of 80 inches or more. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are a few small eroded areas and a similar soil that is underlain by Permian age mudstone at depths of 35 to 50 inches below the soil surface. Small spots of Shrewder soils are in a few mapped areas. The included soils make up about 8 percent of the map unit, but individual areas of the soils are less than 5 acres.

Most areas of this Grandfield soil are used as rangeland. Where management of the mid and tall native grasses is good, the production of forage is high. Brush management is advantageous in areas that have an excessive growth of mesquite or other brushy vegetation. Range seeding of suited species of native grasses is not practical except on abandoned cropland where the climax vegetation has been destroyed by cultivation.

A few areas of this soil are cultivated to small grains and cotton. This Grandfield soil is moderately suited to this use. Controlling erosion is a major concern.

Intensive conservation measures must be taken to protect emerging seedlings from blowing sand and high intensity rainfall. Stubble-mulch tillage, cover crops, wind strips, terracing, contour farming, and grassed waterways help prevent excessive erosion and protect crops. Residue management helps maintain good tilth, reduce soil blowing and crusting, and increase the water infiltration rate. Windbreaks help slow wind velocities and reduce soil blowing. This soil does not have serious limitations for growing trees for windbreaks.

This Grandfield soil is well suited to habitat for openland wildlife and rangeland wildlife.

This soil is capability subclass 3e. It is in the Sandy Loam ecological site.

HaC—Hardeman fine sandy loam, 1 to 5 percent slopes

This very deep, well drained, gently sloping soil is on convex side slopes of the low terraces above flood plains. Areas are oblong and range from 8 to 30 acres.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsoil from 12 to 33 inches is reddish yellow fine sandy loam, and from 33 to 80 inches it is light reddish brown fine sandy loam that contains many masses and threads of calcium carbonate.

The Hardeman soil has medium natural fertility and organic matter content. The soil is slightly alkaline and moderately alkaline and is calcareous within a depth of 28 inches. Permeability is moderately rapid, and surface runoff is very low. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a wide range of soil moisture conditions. Plant roots can easily penetrate the soil to a depth of 80 inches or more. The hazards of water erosion and wind erosion are moderate.

Included with this soil in mapping are small areas of Jester soils on ridges and footslopes and Shrewder and Woodward soils on higher areas. Outcrops of gravel and scattered gravel on the surface are present in a few of the mapped areas. The included soils make up about 15 percent of the map unit, but individual areas of the soil are less than 6 acres.

Some areas of this Hardeman soil are cultivated. The soil is well suited to growing cotton, sorghums, and small grains. The moderate available water capacity of the soil and lack of timely rain limit crop production in most years. Water erosion can be controlled or reduced by using minimum tillage, growing winter cover crops, terracing with grassed waterways, and farming on the contour. Leaving crop residue on or near the surface and using tillage that leaves the surface rough can reduce wind erosion. Returning crop residue to the soil helps improve fertility, reduce crusting, and increase water infiltration.

This soil is used mainly as rangeland. Tall grasses are present in some areas. These well managed areas grow large amounts of native forages. Brush management is practical and feasible on areas that have an excess growth of woody vegetation. Brush management along with deferred grazing help maintain or improve the native forages.

This Hardeman soil is well suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Sandy Loam ecological site.

JaC—Jaywi silty clay loam, 2 to 5 percent slopes

This very deep, well drained gently sloping soil is on uplands. The soil formed in loamy ancient stream terrace deposits and valley colluvium. Areas are incised every 100 to 300 yards by drainageways from the adjacent soils at higher elevations. Narrow and meandering flood plains are common to most areas. Areas are elongated and range from 8 to 200 acres; however, a continuous area without an incised drainageway is generally less than 5 acres.

Typically, the surface layer is brown silty clay loam about 5 inches thick. The subsoil is silty clay loam to a depth of 80 inches. It is brown in the upper 16 inches and reddish brown below.

The Jaywi soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is low. The available water capacity is high. Root development is not restricted to a depth of 60 inches or more. This soil has good tilth and can be worked throughout a moderate range of soil moisture. The hazards of water erosion and wind erosion are moderate.

Included with this soil in mapping are a few small areas of Aspermont, Cottonwood, Quanah, Vernon, and Wheatwood soils. Aspermont, Cottonwood, and Vernon soils are on upper convex slopes, and Quanah soils are on lower concave slopes. These soils make up about 10 percent of some mapped areas. The Wheatwood soils are on narrow flood plains and make up about 15 percent of some mapped areas. Parts of some mapped areas of the Jaywi soils have surface textures of clay loam and loam. Also included are areas that contain large amounts of gypsum in the lower soil layers. These areas occur below Cottonwood soils and gypsum rock outcrops and make up about 15 percent of some mapped areas. Together the included soils make up about 20 percent of the map unit, but individual areas of the included soils are generally less than 8 acres.

Nearly all areas of this Jaywi soil are used as rangeland. Forage production on this soil is high where management is good. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods keep the grasses and soil in good condition. Where the soil is in good condition and adequate forage is present, runoff is slowed and the rainfall enters the soil. Brush management is practical and feasible on areas that have an excess growth of woody vegetation.

Few areas of this Jaywi soil are used as cropland. Tillable areas are mostly less than 5 acres and they are usually adjacent to nontillable shallow soils. If cultivated crops are grown, extensive measures are needed to control or prevent damage from wind and water erosion. Minimum tillage, winter cover crops, terracing, contour farming, and grassed waterways help reduce runoff and erosion. Returning crop residue to the soil helps maintain organic matter, improve fertility, reduce crusting, and increase water infiltration.

This soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Loamy ecological site.

JeE—Jester loamy sand, 3 to 12 percent slopes

This very deep, excessively drained, gently sloping to strongly sloping soil is in hummocky, dune areas on or slightly above flood plains along the Wichita River. Areas are long and narrow and range from 5 to 70 acres.

Typically, the surface layer is light brown loamy sand about 11 inches thick. The underlying material is light reddish brown loamy sand to a depth of 26 inches and pink loamy sand to a depth of 80 inches or more.

The Jester soil has low natural fertility and organic matter content. The soil is slightly alkaline or moderately alkaline throughout. Permeability is rapid, and surface runoff is very low. The available water capacity is low. The plant rooting zone is not restricted. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are small areas of Hardeman and Westola soils between the dunes. The included soils make up about 10 percent of the map unit, but individual areas of the soils are generally less than 5 acres.

This soil is used as rangeland. It is well suited to growing tall native grasses. Forage yields are affected by the low available water capacity and the loose sandy texture. The forage yields on these soils fluctuate greatly according to the amount of rainfall and past management practices.

This Jester soil is not suited to producing cultivated crops. The low water holding capacity, the severe hazard of soil blowing, and the loose sandy surface are the main limitations.

This soil is moderately well suited to habitat for openland wildlife and is well suited to habitat for rangeland wildlife.

The soil is in capability subclass 6e. It is in the Sand Hills ecological site.

KgA—Kingco silty clay loam, 0 to 1 percent slopes

This very deep, moderately well drained, nearly level soil is on weakly concave uplands. In undisturbed areas, surfaces are characterized by gilgai microrelief consisting of microknolls and microdepressions. Areas are oval and range from 10 to 80 acres.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark reddish gray silty clay to a depth of 35 inches, reddish brown silty clay to a depth of 51 inches, and reddish brown silty clay loam to a depth of 82 inches.

The Kingco soil is high in natural fertility and organic matter content. The surface layer is slightly alkaline or moderately alkaline. The subsoil is moderately alkaline and calcareous. Permeability is slow, and surface runoff is medium. Water remains in the microdepressions for a few days following periods of heavy rainfall. The available water capacity is high. The soil has fair tilth and can be worked only in a limited range of soil moisture conditions. The root zone is very deep, but the clayey subsoil layers slow root penetration. The shrink-swell potential is very high, and deep, wide cracks form in the soil when it is dry. The hazards of wind erosion and water erosion are slight.

Included with this soil in mapping are a few small areas of Westill soil on slightly higher convex positions. Also included are a few spots of Lazare soils in deeper depressional areas that pond water for several days following extended rainy periods. The included soils make up about 15 percent of the map unit, but individual areas of the soils are mainly less than 3 acres.

More than half of this Kingco soil is used as rangeland. Forage growing on this soil is highly preferred by grazing animals, and careful management is necessary to minimize overgrazing. The high natural fertility and high available water capacity allow maximum production of good quality native plants. Brush management, along with deferred use, helps maintain or improve the range vegetation.

This Kingco soil responds well to cropland management, and it is well suited to nearly all the crops commonly grown in the county. Minimum tillage, winter cover crops, and residue management help prevent soil loss, improve fertility, reduce surface crusting, and increase water infiltration.

The soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 2s. It is in the Clay Loam ecological site.

KVD—Knoco-Vernon complex, 2 to 8 percent slopes

This complex consists of very shallow to moderately deep, well drained soils on uplands. These soils are on gently sloping to moderately sloping side slope and headcut areas with numerous small drainageways and gullies dissecting the area. Narrow, steep escarpments are common to some areas. Geologic erosion is active in most areas. Areas are elongated and follow the contour of the slope; however areas near headcuts are irregular in shape and range from 15 to 60 acres.

A typical area of this complex is 35 percent Knoco soils, 25 percent Vernon soils, 15 percent geologically eroded areas and rock outcrop, and 25 percent other soils. The Knoco soil is on higher slopes commonly associated with geologically eroded areas. The Vernon soil is on less sloping more stable lower slopes. Individual areas of these soils are so small and so intermingled that it was not practical to map them separately at the selected scale.

Typically, the Knoco soils have a surface layer of reddish brown clay about 16 inches thick. The underlying material is interbedded red and gray noncemented claystone to a depth of 80 inches.

The Knoco soil is low in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is very slow, and surface runoff is very high. The available water capacity is very low. Root development is restricted below about 18 inches. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

Typically, the Vernon soils have a surface layer of reddish brown clay loam about 4 inches thick. The upper part of the subsoil is reddish brown clay to a depth of 23 inches. The lower part of the subsoil from 23 to 29 inches is red clay containing common light gray mottles and small fragments of shale. The underlying material is interbedded red and gray noncemented claystone to a depth of 80 inches.

The Vernon soil is low in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is very slow, and surface runoff is very high. The available water capacity is moderate. Root development is restricted below a depth of about 29 inches. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

Included with these soils in mapping are small areas of contrasting Cottonwood and Talpa soils that have formed on outcrops of gypsum and dolomite. These soils make up as much as 10 percent of the map unit. The drainageways of most areas contain stratified loamy and clayey soil materials deposited over claystone at moderate depths. Other mapped areas of this unit contain as much as 20 percent Aspermont soils. However, not all of these soils are present in all mapped areas. Individual areas of the included soils are less than 6 acres.

This complex is used as rangeland. It is not suited to cropland because of the very shallow soil, rock outcrop, and geologically eroded areas. Production of native plants is limited because of the very high runoff and low available water capacity. Surface crusting, scalding, and runoff increase as vegetation is removed and the soil is trampled. Excellent covers of native grasses are present in areas where grazing is managed and brush is controlled.

The soils of this complex are poorly to moderately suited to habitat for openland wildlife and rangeland wildlife.

The Knoco soil is in capability subclass 6s, and the Vernon soil is in capability subclass 4e. The Knoco soil is in the Very Shallow Clay ecological site and the Vernon soil is in the Shallow Clay ecological site.

LaA—Lazare clay, 0 to 1 percent slopes, occasionally ponded

This very deep, somewhat poorly drained, nearly level soil is in depressional uplands that pond water. Areas are concave and rounded to oblong and range from 3 to 20 acres.

Typically, the surface layer is dark gray clay about 12 inches thick. The subsoil is clay to a depth of 80 inches or more. The upper part is dark gray, the middle part is grayish brown, and the lower part is grayish brown.

The Lazare soil has high natural fertility and organic matter content. The surface layer is slightly alkaline, and the subsoil is calcareous and moderately alkaline. Permeability is very slow and surface runoff is negligible. The soil is ponded for brief periods following heavy rains. It forms deep wide cracks when dry. The available water capacity is high. The surface layer is tillable only through a narrow range of soil moisture. The root zone is very deep, but penetration by plant roots is slow and difficult because of the dense clay. The hazards of water erosion and wind erosion are slight.

Included with this soil in mapping are small areas of Kingco soils surrounding the depressional areas. Also included is a similar clayey soil in lower, poorly drained areas that retain water for long or very long periods of time. The included soils make up as much as 15 percent of the map unit, but individual areas of the soils are generally less than 3 acres.

This Lazare soil is used as rangeland. Areas of this soil are preferred and intensively grazed by livestock. Under proper management, this soil produces abundant forage because of the high available water capacity. Where grazing has been heavy and continuous, the choice grasses have decreased.

This soil is not used for cultivation. During normal years the soil has potential for growing small grains, cotton, and sorghums; however, ponded water could delay early planting and harvesting. During very wet years crop failure would likely occur because of the prolonged presence of ponded water during the growing season.

This soil is poorly suited to habitat for openland wildlife and rangeland wildlife. Some of the mapped areas contain small wet areas that provide temporary habitat for waterfowl.

This soil is in capability subclass 3w, and is in the Lakebed ecological site.

LnA—Lincoln soils, 0 to 1 percent slopes, frequently flooded

This very deep, somewhat excessively drained, nearly level soil is on flood plains, mainly along the North Wichita River. This soil is flooded an average of about once every other year. Brief flooding occurs mainly during the spring through the fall months. The surface texture is mainly loamy sand, but loamy overwash as much as 12 inches thick is present in parts of some areas and dominates entire other areas. Areas are elongated and parallel the stream channels and range from 8 to 60 acres.

Typically, the surface layer is brown loamy sand about 6 inches thick. The underlying material is light reddish brown sand to a depth of 72 inches. From 72 to 80 inches or more is light brown sand. Thin bedding planes and thin loamy and sandy strata are present. Common siliceous gravel is present throughout.

The Lincoln soil is low in natural fertility and organic matter content. The soil is calcareous and moderately alkaline throughout. Permeability is rapid, and runoff is negligible. The available water capacity is low. Plant roots penetrate to a depth of about 78 inches where a water table is encountered. The surface layer is subject to severe wind erosion if the vegetative cover is removed.

Included with this soil in mapping are a few areas of Jester soils on ridges and Westola soils on outer edges of the flood plain. Another similar soil contains a water table within a depth of 40 inches. This soil mainly occurs next to stream channels. The included soils make up about 10 percent of the map unit, but individual areas of the soils are generally less than 8 acres.

Nearly all of this Lincoln soil is used as rangeland. Flooding that scours or buries vegetation with sandy deposits affects forage production. The low available water capacity and low fertility of the loose, sandy soil also adversely affect forage production.

Where the original native grass species are present and management is good, forage production is high during years of favorable rainfall. If grazing is kept at recommended levels the quality native grasses develop deep root systems that can reach and benefit from ground water, which occurs below about 78 inches in many areas.

This soil is poorly suited to cultivated crops. Frequent flooding is a severe hazard. The loose sandy surface and the severe hazard of wind erosion are major management concerns.

Soil areas are used by most local wildlife species. The tall trees growing along stream channels provide excellent roosting sites for turkeys. The soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 5w. It is in the Sandy Bottomland ecological site.

M-W—Miscellaneous water

This unit consists of small, constructed water areas that are used for industrial, sanitary, or mining applications. They contain water most of the year.

MfA—Miles fine sandy loam, 0 to 1 percent slopes

This very deep, well drained, nearly level soil is along swales, concave drainageways, and on upland ridgetops. Areas are irregular in shape and range from 6 to 90 acres.

Typically, the surface layer is brown fine sandy loam about 14 inches thick. The upper part of the subsoil from 14 to 49 inches is reddish brown sandy clay loam. The lower part of the subsoil from 49 to 80 inches is red sandy clay loam.

The Miles soil has medium natural fertility and organic matter content. Reaction of the surface layer is neutral. The upper part of the subsoil is slightly alkaline, and the lower part of the subsoil is moderately alkaline. Permeability is moderate, and surface runoff is negligible. The available water capacity is moderate. The surface is friable and easily tilled throughout a wide range of soil moisture. Root development is not restricted. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included with this soil in mapping are small areas of Grandfield soils on higher ridges and knobs and side slopes. A similar soil in depressional areas has a grayish brown clayey subsoil at depths below 30 inches. In most cultivated areas, wind erosion has removed some of the silt and clay particles from the surface layer so that it is sandier and not as thick as it was before cultivation. The included soils make up about 15 percent of the map unit, but individual areas of the soils are less than 6 acres.

Nearly all of this Miles soil is used for cultivation. It is well suited to growing cotton, sorghums, and small grain, which are all commonly grown. Cultivated crops require careful management to protect emerging seedlings from damaging winds. Terracing, contour farming, cover crops, and residue management help prevent erosion and conserve soil moisture. Windbreaks, cover crops, and crop residue on or near the surface help reduce soil blowing.

When this Miles soil is used as rangeland, production is high where management is good and tall native climax grasses are present. Overgrazing during periods of drought can cause damage to the grass stand. Brush management is advantageous in areas that have an excessive growth of mesquite or other brushy vegetation.

This soil is well suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 2e. It is in the Sandy Loam ecological site.

NoC—Nobscot sand, 1 to 5 percent slopes

This very deep, well drained, gently sloping soil is on undulating and hummocky sandy uplands. Areas are rounded to oblong and range from 5 to 750 acres.

Typically, the surface layer is yellowish brown sand about 8 inches thick. The subsurface layer is pink sand to a depth of 29 inches. The subsoil is red sandy loam with discontinuous bands of reddish brown sandy loam lamellae to a depth of 43 inches. From a depth of 43 to 90 inches is light red and reddish yellow loamy sand containing a few reddish sandy loam lamellae.

The Nobscot soil is low in natural fertility and organic matter content. Reaction of the soil layers is slightly acid or neutral. Permeability is moderately rapid, and runoff is very low. The available water capacity is low. The surface layer is loose and easily tilled throughout a wide range of soil moisture conditions. Root development is not restricted through all layers of the soil. The hazard of water erosion is moderate, and the hazard of wind erosion is severe.

Included with this soil in mapping are a few scattered areas of Delwin, Devol, and Grandfield soils. Also included are a few small, severely eroded blowouts and a few areas that have short elongated slopes that are slightly more than 5 percent. The included soils make up about 20 percent of the map unit, but individual areas of the soils are less than 8 acres.

About 20 to 30 percent of this soil was cultivated at one time, but most of it has been reseeded to grass or has been idle since cultivation. Cropped areas were used for growing cotton, sorghums, and small grains. This soil is poorly suited to cultivation because of severe soil blowing, low available soil moisture, and low fertility. Most of the areas that were cultivated are eroded to some degree. In the severely eroded areas, there are dunes 2 to 10 feet high and blowouts 1 to 3 feet deep. Other wind-deposited soil accumulations from the formerly cultivated fields are 2 to 20 feet in height and are along fence rows or in brushy areas. Maintaining a good grass cover is effective in helping control wind erosion.

This Nobscot soil is mostly used as rangeland. Where climax grasses are present and management is good, production of native forage is high. Brush control by chemical means is needed to control the invasion of shinnery oak. Continuous grazing during dry periods causes the grasses to die out and brush to increase. Wind erosion commonly occurs in areas where vegetative cover is inadequate.

Feral hogs, deer, and game birds inhabit this Nobscot soil. This soil is moderately suited to habitat for openland wildlife and is well suited to habitat for rangeland wildlife.

This soil is in capability subclass 4e. It is in the Sandy ecological site.

NpB—Nipsum silty clay, 0 to 2 percent slopes

This very deep, well drained, nearly level and very gently sloping soil is on low terraces and footslopes. The soil formed in an alluvium and colluvium mixture. Areas are slightly concave and elongated and range from 8 to 60 acres.

Typically, the surface layer is silty clay to a depth of about 29 inches. It is dark reddish gray in the upper part and reddish brown in the lower part. The subsoil is reddish brown clay to a depth of 80 inches.

The Nipsum soil has high natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is slow, and surface runoff is medium to high. The available water capacity is moderate. The surface layer has fair tilth and can be worked only in a limited range of soil moisture. The root zone is very deep, but penetration by plant roots is slow because of the clayey texture. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are small areas of Quanah, Tilvern, and Westill soils. These included soils occur in higher areas. The included soils make up less than 10 percent of the map unit, but individual areas of the soils are less than 5 acres.

Most all of the areas of Nipsum soil are used as rangeland. Forage grown on this soil is highly preferred by grazing animals, and careful management is necessary to minimize overgrazing. Brush management along with deferred use can help hasten range improvement where there is an excessive growth of brush species and some desirable grasses are present.

This soil is well suited to use as cropland. Cotton, small grains, and sorghums are adapted crops for potential cultivation. Minimum tillage, winter cover crops, terracing and contour farming, grassed waterways, and residue management help prevent soil loss and improve water infiltration.

This soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 2e. It is in the Clay Loam ecological site.

ObC—Obaro loam, 1 to 4 percent slopes

This moderately deep, well drained, gently sloping soil is on upland convex ridges. Areas are irregular in shape and range from 8 to 25 acres.

Typically, the surface layer is reddish brown loam about 7 inches thick. The subsoil is yellowish red silty clay loam to a depth of about 23 inches and reddish yellow silty clay loam with an accumulation of calcium carbonate to a depth of about 38 inches. The underlying material is yellowish red loam to a depth of 43 inches and it is stratified with fine sandy loam, mudstone, and siltstone.

The Obaro soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderately slow, and surface runoff is low. The available water capacity is low. The surface layer is friable and is easily tilled through a fairly wide range of soil moisture. The root zone is moderately deep, and plant root development is restricted by unweathered parent material at about 38 inches. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are small areas of Paducah soil on low concave slopes and scattered areas of Woodward soil. Woodward and other soils make up as much as 15 percent of the map unit. An individual area of each soil is generally less than 5 acres.

Most areas of this Obaro soil are used as rangeland. Because of the low available water capacity, only moderate amounts of native forage are produced. The grazing on this soil is rather difficult to manage because livestock prefer its native forage and tend to overgraze. Overgrazing causes soil compaction and brush to thicken. Brush management is advantageous in areas that have an excessive growth of mesquite or other brushy vegetation and some climax forage vegetation remains.

A few areas of this Obaro soil are used for growing crops. Commonly grown crops include cotton, small grains, and sorghums. Because the soil has low water holding capacity, conserving soil moisture is a major concern. Minimum tillage, winter cover crops, terracing and contour farming, and grassed waterways help reduce runoff and erosion. Leaving crop residue on or near the soil surface helps reduce erosion, maintain organic matter, improve fertility, reduce crusting, and increase water infiltration.

This soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 4e. It is in the Loamy Prairie ecological site.

PdB—Paducah loam, 1 to 3 percent slopes

This very deep, well drained, very gently sloping upland soil is on concave footslopes and along and near heads of drainageways. Areas are irregular in shape and range from 8 to 120 acres.

Typically, the surface layer is reddish brown loam about 8 inches thick. The upper part of the subsoil is reddish brown loam to a depth of 13 inches. The middle part of the subsoil is reddish brown and red clay loam to a depth of 39 inches. The lower part of the subsoil is red loam to a depth of 62 inches. The underlying material between depths of 62 and 80 inches is light red noncemented sandstone.

The Paducah soil has medium natural fertility and organic matter content. The surface layer is neutral, and the subsoil is slightly alkaline to moderately alkaline. Permeability is moderate, and surface runoff is low. The available water capacity is high. The surface layer is friable and easily tilled through a fairly wide range of soil moisture. The layer tends to crust following hard rains. The root zone is very deep and is easily penetrated by plant roots. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are small areas of closely similar Carey soils on lower concave slopes and Shrewder and Woodward soils on upper convex slopes. Also included are a few small areas where slope slightly exceeds 3 percent. The included soils make up as much as 15 percent of the map unit, but individual areas of the soils are less than 10 acres.

Many areas of this Paducah soil are cultivated. Cotton is the main crop; however large acreages are seeded to small grains for cool-season grazing (fig. 6). The soil is also well suited to sorghums. Minimum tillage, terracing and contour farming, grassed waterways, winter cover crops, and leaving plant residue on or near the surface help control erosion, improve fertility, reduce surface crusting, and increase water infiltration.

Areas in native grasses are preferred and intensively grazed by livestock. The high available water capacity of this soil helps produce abundant amounts of forage where grazing is well managed. Where grazing has been heavy and continuous, the choice grasses have decreased. Hence, the exposure of bare ground has increased, causing an increase in soil temperature, a loss of moisture, and a decrease in plant vigor.

This soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 2e. It is in the Loamy Prairie ecological site.

Figure 6.—This yellow bluestem was seeded in a cropland field. The soil is Paducah loam, 1 to 3 percent slopes.

QnB—Quanah silty clay loam, 1 to 3 percent slopes

This very deep, well drained, very gently sloping soil is on uplands. Areas are on slightly concave colluvial footslopes below adjacent hills. Areas are irregular to elongated and range from 8 to 120 acres.

Typically, the surface layer is brown silty clay loam to a depth of about 18 inches. The subsoil, from 18 to 34 inches, is brown silty clay loam; from 34 to 50 inches, is brown to reddish brown silty clay loam; and from 50 to 80 inches, is light reddish brown to reddish brown silty clay loam with an accumulation of calcium carbonate.

The Quanah soil has high natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is low. The available water capacity is high. This soil has good tilth and can be worked through a fairly wide range of soil moisture. The hazards of wind erosion and water erosion are moderate.

Included in mapping are a few small areas of Aspermont, Jaywi, Nipsum, Tilvern, and Westill soils. The included soils make up less than 15 percent of the map unit, but individual areas of the soils are generally less than 5 acres.

This Quanah soil is used as rangeland. Short and mid grasses are common on this soil. Forage production is medium where management is good. Overgrazing causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods help keep the grasses and soil in good condition. Brush management along with deferred use hastens range improvement where there is an excessive growth of brush species and some climax grasses are present (fig. 7). This soil is poorly suited to pond sites because of the high content of calcium carbonate in the lower part of the subsoil.

Figure 7.—Mesquite and redberry juniper have invaded the very deep, loamy Quanah soils in the valley fill positions. Redberry juniper grows abundantly on the moderately sloping to steep Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes.

This Quanah soil is well suited to nearly all the crops commonly grown in the county, but areas of this soil are not presently used for growing crops. If the soil is used for cultivated crops, controlling erosion is a management concern. Minimum tillage, winter cover crops, terracing, contour farming, and grassed waterways help reduce runoff and erosion. Returning crop residue to the soil helps maintain or improve fertility, reduce crusting, and increase water infiltration.

This Quanah soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 2e. It is in the Loamy ecological site.

QTD—Quanah-Talpa complex, 3 to 8 percent slopes

This complex consists of gently sloping and moderately sloping, well drained Quanah and Talpa soils on uplands. The Quanah soils are very deep and are on footslopes and valleys. They meander between areas of Talpa soils on hilltops and ridges. Their slopes range from 3 to 5 percent. The Talpa soils are very shallow and shallow and are on convex ridgetops and side slopes. Slopes range from 3 to 8 percent. Individual areas of this soil are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Areas are irregular in shape and range from 30 to 600 acres.

The Quanah soils make up about 54 percent of the map unit. Typically, they have a surface layer of dark brown silty clay loam about 10 inches thick. The subsoil from 10 to 25 inches is brown to reddish brown silty clay loam, and from 25 to 80 inches is light reddish brown loam containing many masses of calcium carbonate.

Quanah soils are high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is low. The available water capacity is high. Root development is not restricted through all layers of the soil. The hazards of wind erosion and water erosion are moderate.

The Talpa soils make up about 36 percent of the map unit. Typically, they have a surface layer of dark brown gravelly loam about 8 inches thick. The underlying material from 8 to 20 inches is indurated and coarsely fractured white dolomitic limestone.

Talpa soils are high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is very high. The rooting depth is restricted by the limestone at very shallow and shallow depths. Plant roots penetrate fractures that are not cemented with coatings of calcium carbonate. The available water capacity is very low. The hazard of wind erosion is slight and the hazard of water erosion is severe.

Included with these soils in mapping are small areas of Aspermont, Tilvern, and Vernon soils on convex side slopes and Cottonwood soils on ridges and side slopes. Also included are narrow bands of outcropped limestone. The included soils and rock outcrop make up about 10 percent of the map unit, but individual areas of the soils are generally less than 5 acres.

All areas of this complex are used as rangeland. Production of native forages is variable because of soil depth. Brush management is advantageous in areas that have an excessive growth of mesquite and juniper. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods help keep the forages and soil in good condition. The soils in this complex are poorly suited for pond sites. The Talpa soil has a shallow depth to limestone and the Quanah soil has a high content of calcium carbonate in the subsoil which causes seepage.

This complex is poorly suited as cropland. The severe water erosion hazard, shallow soils, and the rock outcrop are limitations which are difficult to overcome.

This complex is moderately suited to habitat for openland wildlife and rangeland wildlife.

The Quanah soil is in capability subclass 3e, and is in the Loamy ecological site. The Talpa soil is in capability subclass 7s, and is in the Very Shallow ecological site.

QUG—Quinlan-Rock outcrop complex, 8 to 50 percent slopes

This complex consists of the shallow, well drained, strongly sloping to very steep Quinlan soils and the Rock outcrop on convex uplands. The landscape consists of moderately sloping ridges and moderately steep to very steep escarpments and canyons incised in the smoother uplands. The Quinlan soils are on ridges and escarpments, and the Rock outcrop is exposed at various intervals throughout the mapped areas. Individual areas of Quinlan soils and Rock outcrop are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Areas of this complex are in the western part of the county. They are irregular in shape and range from 30 to 250 acres.

The Quinlan soils make up about 56 percent of the map unit. Typically, they have a surface layer of red very fine sandy loam about 4 inches thick. The subsoil from 4 to 16 inches is light red to red very fine sandy loam that contains about 10 percent gypsum. The underlying material from 16 to 35 inches is stratified red noncemented sandstone containing shale fragments and masses of gypsum.

The Quinlan soils have medium natural fertility and organic matter content. The soil is moderately alkaline and is calcareous. Permeability is moderate, and surface runoff is high. The available water capacity is very low. The underlying sandstone at shallow depths restricts plant root growth. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

The Rock outcrop makes up about 19 percent of the map unit. It consists of exposed, bare, gypsum bedrock on strongly sloping to very steep side slopes. Surface runoff is very high.

Included with this complex in mapping are small areas of Cottonwood soils on less sloping areas over gypsum outcrops and Woodward soils in concave areas above heads of side drains. Narrow flood plains consisting of Yomont soils are included in some mapped areas. The included soils make up about 25 percent of the map unit, but individual areas of the soils are generally less than 5 acres.

All areas of this complex are used as rangeland. Livestock selectively graze this area. Because of the steep slopes and the high content of gypsum in the Quinlan soil, it is not a preferred grazing area, and tall and mid grasses are abundant. Livestock intensely graze the included deeper Woodward and Yomont soils, which contain only minor amounts of gypsum and are more accessible. Some areas of this complex are inaccessible to cattle because of steep slopes and the rock outcrop.

Areas of this complex are not suited to cultivated crops. Soil depth, areas of rock outcrop, and steepness of slope are the main limitations.

The complex is poorly suited to habitat for openland wildlife and rangeland wildlife.

The Quinlan soil is in capability subclass 7e. It is in the Loamy Prairie ecological site. Rock outcrop is in capability subclass 8s and is not assigned an ecological site.

RCG—Rock outcrop-Cottonwood complex, 20 to 45 percent slopes

This complex consists of Rock outcrop and the very shallow, well drained, steep Cottonwood soils on uplands (fig. 8). The landscape consists of steep escarpments below dolomite limestone cap rocks. Stones and boulders broken from the receding cap rock are present on the upper slopes. Rock outcrop mainly occurs as exposed layers of gypsum; however lesser amounts of exposed dolomitic limestone and shale are common

Figure 8.—An area of Cottonwood-Knoco complex, 3 to 20 percent slopes. The steeper areas are part of the Rock outcrop-Cottonwood complex, 20 to 45 percent slopes.

to some areas. The Cottonwood soils are on steep side slopes between rock ledges. Individual areas of Rock outcrop and Cottonwood soils are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Areas of this complex are mainly in the eastern part of the county. They range from 10 to 100 acres.

Rock outcrop makes up about 47 percent of the map unit. It consists of exposed areas of bare, soft gypsum, shale, mudstone, and hard dolomitic limestone bedrock. Geologic erosion is active, and surface runoff is very high.

The Cottonwood soils make up about 39 percent of the map unit. Typically, they have a surface layer of pale brown loam about 9 inches thick. The underlying material is white chalky gypsum.

Cottonwood soils are low in natural fertility and organic matter content. These soils are moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is very high. The available water capacity is very low. Root penetration is restricted to only a few inches into the underlying gypsum. The hazard of wind erosion is moderate and the hazard of water erosion is severe.

Included with this complex in mapping are small areas of steep Knoco soils on side slopes and gently sloping Talpa soils on narrow ridgetops. Some of the areas of this map unit have slopes up to 70 percent. Also included on upper slopes above boulders are pockets of dark colored, moderately deep loamy soils. The included soils make up about 14 percent of the map unit, but individual areas of the soils are less than 5 acres.

All areas of this complex are used as rangeland; however, only a small portion is accessible to cattle. Access is limited because of the steep slopes and rock ledges. Some northerly exposed areas of this complex have excellent growth of tall grasses. These areas have less evaporation and they are generally inaccessible to cattle.

This complex is poorly suited to habitat for openland wildlife and rangeland wildlife.

The Cottonwood soils are in capability subclass 7s and the Gyp ecological site. Rock outcrop is in capability subclass 8s and is not assigned to an ecological site.

ShB—Shrewder very fine sandy loam, 1 to 3 percent slopes

This very deep, well drained, very gently sloping soil is on convex upland ridges. Areas are oblong to irregular and range from 8 to 35 acres.

Typically, the surface layer is reddish brown very fine sandy loam about 14 inches thick. The subsoil is reddish brown and red very fine sandy loam to a depth of 55 inches. The underlying material is red very fine sandy loam to a depth of 65 inches and is red noncemented sandstone to a depth of 80 inches.

The Shrewder soil has medium natural fertility and organic matter content. The surface layer is neutral, and the subsoil is slightly alkaline or moderately alkaline. Permeability is moderately rapid, and surface runoff is very low. The available water capacity is high. The surface layer is friable and easily tilled through a wide range of soil moisture conditions. This soil tends to crust after hard rains. Root penetration is not impeded until noncemented sandstone layers are encountered below a depth of 60 inches or more. The hazard of wind erosion is moderate, and the hazard of water erosion is moderate.

Included with this soil in mapping are a few small areas of Paducah soils in concave lower slopes and Woodward soils on convex upper slopes. The included soils make up about 10 percent of the map unit, but individual areas of the soils are less than 8 acres.

This Shrewder soil is well suited to growing crops. Adapted crops include cotton, wheat, and sorghums. This soil readily absorbs water, which is easily extracted by plant roots. Growing cover crops and leaving plant residues on or near the surface help control erosion, reduce crusting, and increase water infiltration. Minimum tillage, terracing and contour farming, and grassed waterways also help control erosion.

Many areas of this soil are in rangeland. A wide variety of native plants grow on this soil. Good management is needed to keep vegetative cover on the soil and to help plants maintain their vigor. Where plant vigor is maintained, forage production is high.

This soil is well suited to habitat for openland and rangeland wildlife. There are no major limitations for growing shrubs and trees.

This soil is in capability subclass 2e. It is in the Sandy Loam ecological site.

ShC—Shrewder very fine sandy loam, 3 to 5 percent slopes

This very deep, well drained, gently sloping soil is on convex upland ridges and side slopes. Areas are oblong to irregular and range from 8 to 60 acres.

Typically, the surface layer is reddish brown very fine sandy loam about 16 inches thick. The subsoil is very fine sandy loam to a depth of 60 inches. It is reddish brown in the upper part, red in the middle part, and light red in the lower part. The underlying material is light red, noncemented sandstone to a depth of 80 inches.

The Shrewder soil has medium natural fertility and organic matter content. The surface layer is neutral, and the subsoil is slightly alkaline or moderately alkaline. Permeability is moderately rapid, and surface runoff is very low. The available water capacity is high. The surface layer is friable and easily tilled through a wide range of moisture conditions. Roots easily penetrate the soil until sandstone is encountered. The hazards of wind erosion and water erosion are moderate.

Included with this soil in mapping are a few small areas of scattered Devol, Grandfield, and Woodward soils. Also included are some areas that have a slope as high as 6 percent. Some of the cultivated areas contain eroded spots up to 2 acres in size. The included soils make up about 15 percent of the map unit, but individual areas of the soils are less than 10 acres.

Most areas of this Shrewder soil are used as rangeland. The soil readily absorbs water, and it has the potential for producing large amounts of native forage where grazing has been reasonably well managed.

A few areas of this soil are used for growing small grains, cotton, and forage sorghums. Controlling erosion is a major concern. Minimum tillage and leaving crop residue on or near the surface help control erosion, increase water infiltration, and reduce runoff. Terraces are needed to divert runoff to protected drainageways that are in perennial vegetation. Terraces help control runoff and erosion and act as a guide for cultivation on the contour.

The soil is well suited to habitat for openland and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Sandy Loam ecological site.

SpA—St. Paul silt loam, 0 to 1 percent slopes

This very deep, well drained, nearly level soil is on slightly concave uplands. Areas are oblong and range from 10 to 80 acres.

Typically, the surface layer is dark reddish gray silt loam about 18 inches thick. The upper part of the subsoil is reddish brown silt loam to a depth of 24 inches. The next part of the subsoil is reddish brown silty clay loam to a depth of 46 inches. Between 46 and 80 inches the subsoil is loam that is yellowish red in the upper part and brown in the lower part.

The St. Paul soil has high natural fertility and organic matter content. The surface layers are slightly alkaline, and the subsoil is slightly and moderately alkaline. Permeability is moderately slow, and surface runoff is low. The available water capacity is high. The surface layer is friable and easily tilled through a fairly wide range of moisture conditions. A crust forms after hard rains. The root zone is unrestricted to a depth of 80 inches or more, but penetration by plant roots is slowed by the silty clay loam layers. The hazard of wind erosion is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are small areas of the closely similar Carey soils on slightly higher, weakly convex slopes and Acme soils in lower concave areas. The included soils make up about 15 percent of the map unit, but individual areas of the soils are less than 6 acres.

Most areas of this St. Paul soil are cultivated. Cotton is the main crop; however, alfalfa, wheat, and forage and grain sorghums are also well adapted to this soil. Growing winter cover crops, using minimum tillage, and leaving crop residue on or near the surface help reduce soil blowing, improve fertility, reduce surface crusting, and increase water infiltration.

Livestock extensively graze areas of this St. Paul soil. The high natural fertility and high water holding capacity of this soil combine to make this one of the most preferred grazing sites. Because of continuous grazing, choice climax plants are not always present. When good management practices are used, this soil produces large amounts of quality native forage.

The soil is well suited to habitat for openland wildlife and moderately suited to habitat for rangeland wildlife.

The soil is in capability subclass 2c. It is in the Clay Loam ecological site.

TaC—Talpa gravelly loam, 1 to 5 percent slopes

This very shallow and shallow, well drained, gently sloping soil is on convex dolomitic limestone ridgetops. Areas are irregular in shape and range from 10 to 1,200 acres.

Typically, the surface layer is brown gravelly loam about 9 inches thick. The underlying material is indurated, very pale brown limestone that is fractured in the upper few inches.

The Talpa soil is high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and runoff is very high. The available water capacity is very low. The rooting zone is restricted by fractured limestone at very shallow and shallow depths. If fractures are not sealed with calcium carbonate, many roots penetrate fractures and obtain extra moisture. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

Included with this soil in mapping are small areas of Cottonwood soils on side slopes and Quanah soils in lower concave areas. A few rock outcrops occur along breaks. Cobbles and stones are on the surface in a few small scattered areas, mainly near breaks. The included soils and outcrops make up less than 20 percent of the map unit, but individual areas of the soils are less than 5 acres.

Nearly all areas of this soil are used as rangeland. Because of the limited rooting depth, available moisture is very low and forage production is low. Overgrazing or grazing during prolonged dry periods is detrimental to grass stands and causes excessive runoff and poor tilth. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods help keep forage and soil in good condition.

This Talpa soil is not suited to cultivated crops because of the very shallow depth to rock and rock outcrops.

The soil is poorly suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife. Many areas of this soil produce a wide variety of choice browse for deer.

This soil is in capability subclass 7s, and is in the Very Shallow ecological site.

TKG—Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes

This complex consists of very shallow and shallow, well drained Talpa and Knoco soils and Rock outcrop on uplands (fig. 9). This landscape consists of the walls of deeply incised valleys or narrow ridges of hills and their adjoining side slopes. Layers of dolomitic limestone, shale, and an occasional layer of gypsum, outcrop on the side slopes and form a series of benches and escarpments. The hills have long narrow ridges which are capped with dolomitic limestone. Many small drainageways dissect the side slopes and contribute to the larger valley floor stream.

The moderately sloping to steep Talpa soils formed in material weathered from limestone. They are on narrow ridges, small mesas, and narrow bands above escarpments. The moderately sloping to steep Knoco soils formed in claystone materials on the side slopes and escarpments below rock ledges. The Rock outcrop occurs as 1-to 8-feet-thick ledges of limestone and gypsum. These rock outcrops are exposed at the edge of the summit and at various elevations throughout the map unit. In many areas cobbles, stones, and large boulders have broken from the ledges and are imbedded in the soil below. Individual areas of Talpa and Knoco soils and Rock outcrop are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Slope is dominantly 5 to 30 percent, but in some areas the narrow escarpments slope as much as 50 percent or more. Areas of this complex are irregular in shape and range from 80 to 3,000 acres.

The Talpa soils make up about 63 percent of the map unit. Typically, they have a surface layer of brown gravelly loam about 9 inches thick. From 9 to 16 inches is indurated, fractured dolomitic limestone with a discontinuous coating of strongly cemented re-precipitated calcium carbonate about 1 inch thick on the limestone surface. Loose and weakly cemented calcium carbonate is in the cracks and crevices. The underlying material is indurated dolomitic limestone containing a few fractures.

Talpa soils are high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is very high. The available water capacity is very low. Plant roots are restricted by the underlying limestone to depths of less than 20 inches; however some roots penetrate fractures not sealed by caliche and receive extra moisture. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

Figure 9.—A pond in an area of Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes. Broken-up layers of dolomitic limestone are exposed. Most of the pond lies in the claystone from which Knoco soils form.

The Knoco soils make up about 24 percent of the map unit. Typically, the surface layer to a depth of 5 inches is reddish brown bouldery clay. The next layer from 5 to 14 inches is red clay. The underlying material is slightly weathered, red noncemented claystone interbedded with light olive gray noncemented claystone to a depth of 30 inches or more.

Knoco soils are low in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is very slow, and surface runoff is very high. The available water capacity is very low. Dense noncemented claystone is at depths of less than 20 inches. It restricts penetration by plant roots. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

Rock outcrop makes up about 7 percent of the map unit. It is mainly exposed, indurated limestone and in some areas includes bands of gypsum. Surface runoff is very high.

Included with this complex in mapping are small areas of Aspermont, Cottonwood, Foursixes, and Quanah soils. Also included is another similar soil that is underlain by dolomitic limestone at moderate depths. Aspermont and Quanah soils are in small concave areas and along minor drainageways. Quanah soils are also in some of the included small sinkholes on ridgetops. Cottonwood soils are on material weathered from outcrops of gypsum. Foursixes soils are on narrow and flat areas of limestone. Also included near edges of limestone outcrops is a soil similar to Talpa that contains as much as 50 percent fragments of limestone. All the included soils make up about 6 percent of the map unit, but individual areas of the soils are generally less than 5 acres. This complex is used as rangeland. Production of forage is limited by the restricted rooting depth, very low available water capacity, and the very high runoff. Steep slopes and large boulders prohibit livestock grazing in certain parts of the complex. Forage production is further reduced by thick stands of redberry juniper. Because the juniper growing on this complex has a shallow rooting depth, chaining is an effective control measure where slopes will support equipment.

Figure 10.—Area of Talpa-Knoco-Rock outcrop 5 to 30 percent slopes. Rangeland and wildlife habitat are the main land uses.

The soils in this complex are not suited to cultivation. Steep slopes and Rock outcrop are the main limitations.

The complex is poorly suited to habitat for openland wildlife. It is moderately suited to habitat for rangeland wildlife (fig. 10).

The Talpa soil is in capability subclass 7s and is in the Very Shallow ecological site.

The Knoco soil is in capability subclass 7s and is in the Rocky Hill ecological site.

The Rock outcrop is in capability subclass 8s and is not assigned to an ecological site.

TQB—Talpa-Quanah complex, 0 to 3 percent slopes

This complex consists of well drained, nearly level and very gently sloping soils on karst uplands. The Talpa soils are very shallow, and the Quanah soils are very deep. These soils are on high broad dolomitic limestone ridgetops which are underlain by beds of gypsum. The Talpa soils are on convex ridges underlain by dolomitic limestone. The Quanah soils are on short footslopes below the Talpa soils and are on the outer edges of large sink holes. The sink holes are about 0.5 to 4 acres in size, 75 to 225 feet apart, and are about 5 to 25 or more feet deeper than the ridgetops of the surrounding Talpa soils. Water entering the sink holes usually drains into a nearby cavern. Some of the sink holes are not naturally drained and water is ponded for various periods. Included soils occupy the depressions and lower parts of the sink areas. The included soils are very deep and have clayey subsoils. Individual areas of Talpa and Quanah soils are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Areas are irregular in shape and range from 5 to 1,600 acres.

The Talpa soils make up about 41 percent of the map unit. Typically, they have a surface layer of dark brown gravelly clay loam about 14 inches thick. The underlying material from 14 to 20 or more inches is white indurated dolomitic limestone that is coarsely fractured.

Talpa soils are high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is very high. The available water capacity is very low. The rooting zone is restricted by limestone at depths of 5 to 20 inches. Plant roots penetrate fractures that are not sealed with coatings of calcium carbonate. The hazard of wind erosion is slight, and the hazard of water erosion is severe.

The Quanah soils make up about 30 percent of the map unit. Typically, they have a surface layer of dark brown silty clay loam about 10 inches thick. The subsoil, from 10 to 15 inches is reddish brown silty clay loam, from 15 to 55 inches is yellowish red silty clay loam, and from 55 to 80 inches is reddish yellow loam that contains masses of calcium carbonate.

The Quanah soils are high in natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderate, and surface runoff is low. The available water capacity is high. The root zone is very deep, and plant root development is generally not restricted. The hazards of wind erosion and water erosion are moderate.

Included with these soils in mapping are small areas of very deep soils in and near depressions in the sink areas. Lazare soils occupy the lower depressional areas within the sinks. This soil has gilgai microrelief and forms deep wide cracks when dry. Another soil within the sinks is on slightly higher areas than the adjacent Lazare soils. This soil also occurs in swales leading into the sinks. It has a dark brown clay loam surface layer and a clay subsoil. Together these soils make up about 26 percent of the map unit, but their combined size in any one sink area is generally less than 4 acres. Also included near ridgetops are small areas of shallow and moderately deep soils over dolomitic limestone and a few narrow rock outcrops that together make up about 3 percent of the map unit.

This complex is used entirely as rangeland. Forage production on these areas is quite variable because soil depth ranges from very shallow to very deep. Brush management along with deferred grazing helps maintain or improve the range vegetation where there is an excessive growth of brush species and some climax grasses are present.

The soils of this complex are not used as cropland. The Talpa soils are poorly suited to growing crops because of shallow depths to bedrock. The Quanah soils are well suited to cultivated crops, but small scattered acreages make farming this soil impractical.

Quanah soils and the other very deep soils in this complex are well suited to habitat for openland wildlife, and Talpa soils are poorly suited. Both Quanah and Talpa soils are moderately suited to habitat for rangeland wildlife.

The Talpa soil is in capability subclass 7s and is in the Very Shallow ecological site.

The Quanah soil is in capability subclass 2e and is in the Loamy ecological site.

TvB—Tilvern clay loam, 1 to 3 percent slopes

This deep, well drained, very gently sloping soil is on broad, convex uplands. Areas are irregular in shape and range from 10 to 200 acres.

Typically, the surface layer is brown clay loam about 5 inches thick. The subsoil is reddish brown clay to a depth of about 53 inches. The underlying material is reddish brown mudstone and contains grayish streaks and splotches to a depth of 80 inches.

The Tilvern soil has medium natural fertility and organic matter content. The surface layer is slightly alkaline, and the subsoil is moderately alkaline and is calcareous below a depth of 12 inches. Permeability is very slow, and runoff is very high. The available water capacity is moderate. The surface layer is firm, and can be tilled only in a narrow range of moisture conditions. It has a distinct tendency to crust. Root development is difficult and slow in the dense clayey subsoil layers. The hazard of water erosion is severe, and the hazard of wind erosion is moderate.

Included with this soil in mapping are areas that contain Aspermont soils on lower slopes and Vernon and Knoco soils on upper slopes. A few small areas of Westill soils are on lower concave slopes and ridgetops. The included soils make up about 20 percent of the map unit, but individual areas of the soils are less than 8 acres.

Most areas of this Tilvern soil are used as rangeland. Abundant forage is produced in areas where grazing is controlled and climax grasses remain. Brush management is advantageous in areas that have an excessive growth of mesquite or other brushy vegetation.

A few areas of this Tilvern soil are cultivated. Wheat is grown mainly for livestock grazing, and forage sorghums are grown for hay and grazing. This soil is rather droughty, and the amount of available moisture is often too low for crops to grow well in summer. The soil is better suited to crops grown during the cool season. Terracing, farming on the contour, and managing crop residue help prevent erosion, increase water infiltration, maintain tilth, and reduce surface crusting.

The Tilvern soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 3e. It is in the Shallow Clay ecological site.

W—Water

This unit consists of natural or constructed areas that contain water most of the year. Areas include streams, rivers, ponds, and lakes.

WcA—Westill clay loam, 0 to 1 percent slopes

This deep, well drained, nearly level soil is on upland flats. Areas are elongated to broad and wide and range from 15 to 180 acres.

Typically, the surface layer is reddish brown clay loam about 10 inches thick. The subsoil from 10 to 22 inches is reddish brown clay; from 22 to 58 inches is reddish brown clay containing masses and concretions of calcium carbonate. The underlying material is stratified reddish brown and light olive gray mudstone to a depth of 80 inches or more.

The Westill soil has high natural fertility and organic matter content. The soil is slightly alkaline in the surface layer and moderately alkaline in the subsoil. Permeability is very slow, and runoff is high. The available water capacity is moderate. The soil has good structure in the surface layer. It can be worked throughout a limited range of soil moisture conditions. The root zone is deep, but the lower part of the subsoil has layers that are dense angular blocky clays and this slows and restricts root penetration. The hazards of wind and water erosion are slight.

Included with this soil in mapping are a few small areas of Kingco soils on small concave areas and Tilvern soils on low convex ridges. Also included are soils closely similar to Westill soils in which the thickness of the surface layer and subsoil layer combined is more than 60 inches. The included soils make up as much as 15 percent of some areas of the map unit, but individual areas of the soils are less than 6 acres. Also included are areas of Westill soils that have a slope up to 1.5 percent. Some of these more sloping areas make up as much as 50 percent of certain mapped areas.

Most of this Westill soil is used as rangeland. The high natural fertility of the soil and good management help to maintain forage species that are preferred by livestock. Brush management is practical and feasible on areas that have an excess growth of woody vegetation (fig. 11). Deferred use can hasten range improvement where some climax grasses are present. This soil does not produce a wide variety of native plants. The subsoil is droughty, and forage production is limited.

Figure 11.—Mesquite on the nearly level Westill soils has been controlled by aerial spraying. Redberry juniper is invading the shallow, gently sloping Talpa soils in the background.

Many areas of this Westill soil are cultivated. It is well suited to growing cotton, small grains, and sorghums. Lack of dependable moisture during the growing season lowers crop yields. Many acres of this soil are planted to small grains and used for grazing stocker cattle throughout the cool season. Large flocks of wild geese feed on certain fields planted to small grains. Minimum tillage, winter cover crops, terracing, grassed waterways, and residue management help to prevent soil losses, improve fertility, reduce surface crusting, and improve water infiltration.

This soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 2s, and is in the Clay Loam ecological site.

WeA—Westola fine sandy loam, 0 to 1 percent slopes, occasionally flooded

This very deep, well drained, nearly level soil is on flood plains that border rivers and large creeks. Areas are about 3 to 6 feet higher than the adjacent frequently flooded flood plain. The soil is very briefly flooded as much as three times in about 20 or more years. The surface contains many low ridges and shallow swales. Areas are elongated and parallel the stream channel and range from 10 to 45 acres.

Typically, the surface layer is brown fine sandy loam about 5 inches thick. The underlying material to a depth of 41 inches is stratified yellowish red and reddish brown fine sandy loam and thin strata of loamy sand. From 41 to 52 inches is yellowish red loamy fine sand stratified with thin strata of fine sandy loam and loamy sand. From 52 to 80 inches is pink fine sand containing few thin loamy fine sand strata and few rounded siliceous gravels.

The Westola soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderately rapid, and surface runoff is negligible. The available water capacity is high. The surface layer is very friable and is easily tilled through a wide range of soil moisture conditions. Root development is not restricted to a depth of 80 inches or more. The hazard of wind erosion is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are a few small areas of Lincoln soils that are occasionally flooded. This Lincoln soil has a surface layer of fine sandy loam to a depth of 12 to 24 inches, and this layer is underlain by sand. This included soil is not present in all areas, but makes up as much as 15 percent of a few areas of the map unit. Individual areas are generally less than 4 acres.

This soil is mostly used as rangeland. Production is high where management is good and some climax grasses are present. Brush management is practical and feasible on areas that have an excess growth of woody vegetation. Deferred grazing will hasten range improvement where climax grasses are present. Prolonged grazing during extended dry periods causes desirable grasses to die out.

This soil is well suited to growing cultivated crops such as cotton, small grains, and sorghums. Where the soil is used for cultivated crops, intensive conservation measures are required to control soil blowing. Minimum tillage and leaving crop residues on or near the soil surface along with cool-season grasses and cover crops, and windbreaks help control soil erosion, maintain organic matter content, and improve fertility and tilth.

This Westola soil has few limitations for growing trees for windbreaks and other woody species for wildlife. It is well suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 2w, and is in the Loamy Bottomland ecological site.

WfA—Westola fine sandy loam, 0 to 1 percent slopes, frequently flooded

This very deep, well drained, nearly level soil is on flood plains of major streams (fig. 12). The soil is flooded about three or more times every 5 years for very brief periods. The surface is uneven, as flooding has left a series of wide shallow channels and low ridges. Areas are long and narrow and range from 30 to 300 acres.

Typically, the surface layer is reddish brown fine sandy loam about 4 inches thick. The underlying material to a depth of 14 inches is light reddish brown fine sandy loam stratified with layers of very fine sandy loam. Below, to a depth of 80 inches is pink fine sandy loam that contains many thinly bedded strata of fine sandy loam, loam, and loamy fine sand.

The Westola soil has medium natural fertility and organic matter content. The soil typically is moderately alkaline and calcareous throughout. Permeability is moderately rapid, and surface runoff is negligible. The available water capacity is moderate. Plant roots can easily penetrate this soil to a depth of 80 inches or more. The hazard of wind erosion is moderate, and the hazard of water erosion is slight.

Included with this soil in mapping are a few small areas of Lincoln soils near channel levees and Yomont soils in scattered areas near adjoining uplands. An occasional long and narrow dune of Jester soils occurs in a few areas. Also included are long narrow areas adjoining stream channels that have a saline water table that fluctuates from near the surface to a depth of 40 inches or more. The included soils make up about 15 percent of the map unit, but individual areas of the soils are less than 12 acres.

Because of the frequent flooding, this Westola soil is used as rangeland. The soil absorbs water readily, and it has high forage production potential. If grazing is reasonably well managed, tall grasses grow well on this soil. Continued close grazing, however, causes the tall grasses to lose their vigor.

The soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 5w. It is in the Loamy Bottomland ecological site.

Figure 12.—Westola fine sandy loam, 0 to 1 percent slopes, frequently flooded, flanks the sides of the South Wichita River. The river cutting into the hill exposes layers of shale and gypsum rocks. Knoco and Cottonwood soils weathered from rock layers such as these.

WhA—Wheatwood loam, 0 to 1 percent slopes, frequently flooded

This very deep, well drained, nearly level soil is on flood plains. Most areas of this soil are subject to very brief flooding on an average of once every 2 years. The soil areas are dissected by meandering stream channels. The channels frequently cross the entire width of the flood plain. Areas between the meandering stream channels are mainly less than 5 acres. Delineations are long and narrow and range from 10 acres to 80 acres.

Typically, the surface layer is reddish brown loam about 4 inches thick. The subsoil to a depth of 27 inches is yellowish red loam. Between depths of 27 to 80 inches is yellowish red and red silty clay loam containing strata of loam and very fine sandy loam.

The Wheatwood soil is high in natural fertility and medium in organic matter content. The soil is moderately alkaline throughout. Free calcium carbonate is in all horizons, and gypsum crystals are common in the subsoil below 27 inches. Permeability is moderate, and surface runoff is negligible. The available water capacity is high. The root zone is very deep, and root development generally is not restricted. The hazard of wind erosion is slight, and the hazard of water erosion is slight.

Included with this soil in mapping are small areas of Yomont soils on or near stream levees and a few areas of Wheatwood soils on higher areas that do not flood as often as once every 2 years. A few areas of gently sloping Jaywi soils on nearby adjacent footslopes are included in some areas. The texture of the surface layer in some of the map units also includes silt loam or silty clay loam. The included soils make up about 10 percent of the map unit, but individual areas of the soils are less than 12 acres (fig. 13).

Figure 13.—A scenic view in King County. The soils in the flood plain are in an area of Wheatwood loam, 0 to 1 percent slopes, frequently flooded. Jaywi soils are in the valley fill position above the flood plain. Cottonwood and Knoco soils are on side slopes. Talpa soils are on the ridgetops.

This Wheatwood soil is used as rangeland. A wide variety of plants grow on this site, and the forage produced is highly preferred by grazing animals. The production of native grasses is high where controlled grazing, proper stocking rates, and other good management practices are used.

This soil is not used for cultivated crops because of the frequent flooding and small inaccessible areas.

Areas of this soil are moderately suited to habitat for both openland and rangeland wildlife. Several species of native trees grow on this site and produce food and resting areas for wildlife.

This soil is in capability subclass 5w. It is in the Loamy Bottomland ecological site.

WoC—Woodward loam, 2 to 5 percent slopes

This moderately deep, well drained, gently sloping soil is on broad convex upland side slopes and ridges. Areas are irregular in shape and range from 6 to 80 acres.

Typically, the surface layer is reddish brown loam about 8 inches thick. The subsoil is yellowish red loam to a depth of about 20 inches and red loam to a depth of about 38 inches. The underlying material is red and light red, soft, noncemented sandstone to a depth of 80 inches.

The Woodward soil has medium natural fertility and organic matter content. The soil is slightly alkaline or moderately alkaline throughout. Permeability is moderately slow, and surface runoff is low. The available water capacity is moderate. The surface layer is friable and easily tilled through a wide range of soil moisture conditions. It tends to crust or puddle after hard rains. Plant roots easily penetrate this soil, but soft sandstone at a depth of about 38 inches restricts growth.

Included with this soil in mapping are a few small areas of scattered Obaro soils, where mudstone strata are intermixed with the soft sandstone parent material; Paducah soils on concave areas; and Quinlan soils on small knobs and rims of upper convex slopes. The included soils make up about 15 percent of the map unit, but individual areas of the soils are mainly less than 6 acres.

Many areas of this Woodward soil are cultivated. Cotton, wheat, and sorghums are commonly grown. Production is somewhat limited by the moderate rooting depth and the moderate water holding capacity. Where this soil is used for crops, the hazards of wind and water erosion are moderate. Terraces are needed to divert water runoff to vegetated drainageways. Growing winter cover crops and crops in strips helps reduce erosion. Leaving crop residue on or near the soil surface helps maintain or improve fertility, reduce crusting, and increase water infiltration.

This soil is used extensively as rangeland. Where management is good, the production of native grasses is high. In some areas in which grazing has been continuous and heavy, low quality forage species have replaced desirable species.

The soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 3e. It is in the Loamy Prairie ecological site.

WoD—Woodward loam, 5 to 8 percent slopes

This moderately deep, well drained, moderately sloping soil is on uplands. It is on side slopes of convex ridges and side slopes above drainageways. Areas are oval to elongated and range from 10 to 200 acres.

Typically, the surface layer is reddish brown loam about 12 inches thick. The subsoil is yellowish red loam to a depth of 28 inches and red loam to a depth of 34 inches. The underlying material is stratified noncemented sandstone containing strata of red loamy material to a depth of 80 inches.

The Woodward soil has medium natural fertility and organic matter content. The soil is calcareous and slightly alkaline or moderately alkaline throughout. Permeability is moderately slow, and surface runoff is medium. The available water capacity is moderate. The surface layer is friable and is easily tilled through a wide range of soil moisture conditions. Plant root development is restricted by stratified and fractured soft sandstone at moderate depths. The hazard of water erosion is severe, and the hazard of wind erosion is moderate.

Included with this soil in mapping are a few small areas of Quinlan soils on upper side slope rims and Shrewder soils on footslopes. In a few areas an occasional outcrop of alabaster gypsum rock is present. The included soils make up as much as 20 percent of the map unit, but individual areas of the soils are generally less than 8 acres.

Nearly all of this Woodward soil is used as rangeland. Production of native grasses is high where management is good. Brush management along with deferred grazing hastens range improvement where there is an excessive growth of brush species and some climax grasses are present. In areas no longer cultivated and lacking desirable plant species, a complete seedbed preparation followed by range seeding offers the best opportunity for range improvement.

A few minor areas of this soil are used for cultivation. Cotton, sorghums, and wheat are grown. The soil is marginally suited to this use. The severe hazard of water erosion is a major concern. Maintaining terraces, farming on the contour, and managing residue help reduce erosion and runoff. The steep backslopes of terraces are limitations for farm equipment.

The soil is well suited to habitat for openland wildlife and is moderately suited to habitat for rangeland wildlife.

This soil is in capability subclass 4e. It is in the Loamy Prairie ecological site.

WQF—Woodward-Quinlan complex, 5 to 15 percent slopes

This complex consists of well drained, moderately sloping to moderately steep Woodward and Quinlan soils on convex uplands of the loamy Permian red beds. Slopes are dominantly 5 to 8 percent, but in some areas slopes are as much as 15 percent. The Woodward soils are moderately deep and are on side slopes and areas between ridges. The Quinlan soils are shallow and occupy ridgetops, upper side slopes, and small escarpments. Individual areas of these soils are so intermingled or so small that to separate them at the scale selected for mapping was not practical. Areas are irregular in shape and range from 20 to 1,500 acres.

The Woodward soils make up about 69 percent of the map unit. Typically, they have a surface layer of yellowish red loam about 7 inches thick. The subsoil is red loam to a depth of 28 inches. The underlying material to a depth of 80 inches or more is stratified noncemented reddish yellow calcareous sandstone containing white streaks, mottles, and few thin strata of red shale.

Woodward soils are medium in natural fertility and organic matter content. The surface layer is slightly alkaline or moderately alkaline and calcareous. The subsoil is moderately alkaline and calcareous. Permeability is moderate, and surface runoff is medium. The available water capacity is low. The plant root zone is moderately deep, and the underlying sandstone restricts root penetration. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

The Quinlan soils make up about 23 percent of the map unit. Typically, they have a surface layer of yellowish red loam about 5 inches thick. The upper part of the subsoil from 5 to 11 inches is red loam. The lower part of the subsoil is reddish brown silt loam to a depth of 16 inches. The underlying material to a depth of 80 inches or more is stratified noncemented calcareous red siltstone and reddish yellow sandstone that contains a few white streaks and mottles.

Quinlan soils are medium in natural fertility and organic matter content. The surface layer is slightly alkaline to moderately alkaline and calcareous. The subsoil is moderately alkaline and calcareous. Permeability is moderate, and surface runoff is medium. The available water capacity is very low. The plant root zone is easily penetrated, but siltstone or sandstone at shallow depths restricts roots. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

Included with these soils in mapping are a few small areas of Shrewder soils on convex to concave footslopes. Many areas contain 1 or 2 thin bands of alabaster gypsum that outcrop on the upper side slopes. A few large uncrossable gullies are present in a few areas. The included soils and outcrops make up about 8 percent of the map unit, but individual areas of the soils are generally less than 5 acres.

Most areas of this complex are used as rangeland. Once these soils produced mid and tall grasses, but continuous grazing has caused the original grasses to be replaced by short grasses. Where grazing has been long and continuous, weedy annuals and mesquite are invading. Brush control along with deferred use hastens range improvement where there is an excessive growth of mesquite and some climax grasses are present. Range seeding is not practical except on abandoned cultivated land where the climax vegetation has been destroyed by cultivation. Proper stocking rates, timely deferment and rotation of grazing, and restricted use during dry periods help keep the grasses and soil in good condition.

This complex is poorly suited to cultivated crops. The steep slopes, rock outcrop, and the shallow depth to bedrock are the main limitations. There is also a severe hazard of water erosion.

The soils in this complex are moderately suited to habitat for openland wildlife and are poorly suited to habitat for rangeland wildlife.

The Woodward and Quinlan soils are in capability subclass 6e. Each soil is in the Loamy Prairie ecological site.

WQG—Woodward-Quinlan-Rough broken land complex, 5 to 45 percent slopes

This complex consists of a vast network of gullies and associated soils that formed in noncemented Permian age sandstones, packsands, and loamy materials. Areas consist of the well drained moderately sloping to steep Woodward and Quinlan soils above narrow loamy flood plains and above the rims of gullies. The well drained, strongly sloping to steep Rough broken land occupies the geologically eroded uplands above the drainageways. Areas are elongated and winding and range from 10 to 2,000 acres. Individual areas of these soils are so intermingled or so small that to separate them at the scale selected for mapping was not practical.

This complex is formed from a main gully that has many secondary gullies. Most of these gullies also have many finger-like branches that run back from the secondary gullies. In some areas the gullies are cutting back to the tops of the ridges above. Here the gullies range from 10 to 30 feet in depth and from 15 to 80 feet in width. Where the main gully flattens and somewhat stabilizes, colluvium and alluvium is deposited from the nearby eroding rough breaks and gullies. Yomont soils have weathered from these stratified and loamy deposits and are an important part of this map unit. These nearly level and very gently sloping Yomont soils on flood plains commonly range from 10 to about 200 feet in width and are adjacent to the main drainageway.

The Woodward soils make up about 34 percent of the map unit. Typically, they have a surface layer of reddish brown loam about 9 inches thick. The subsoil to a depth of 29 inches is yellowish red loam. The underlying material to a depth of 80 inches or more is stratified reddish yellow noncemented calcareous sandstone containing light gray strata and mottles.

Woodward soils are medium in natural fertility and organic matter content. The soil is moderately alkaline and is calcareous throughout. Permeability is moderate, and surface runoff is high. The available water capacity is low. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

The Quinlan soils make up about 29 percent of the map unit. Typically, they have a surface layer of yellowish red loam about 4 inches thick. The subsoil to a depth of 14 inches is yellowish red loam. The underlying material to depths of 80 inches or more is stratified reddish yellow noncemented calcareous sandstone containing pale yellow and light gray strata and mottles.

Quinlan soils are medium in natural fertility and organic matter content. The soil is moderately alkaline and is calcareous throughout. Permeability is moderate, and surface runoff is high. The available water capacity is very low. The hazard of wind erosion is moderate, and the hazard of water erosion is severe.

The Rough broken land makes up about 19 percent of the map unit. Typically, the area is exposed unweathered, soft Permian age sandstone and packsand. Exposed strata of gypsum and silty red beds are present in some areas.

Rough broken land materials are low in natural fertility and organic matter content. They are moderately alkaline and are calcareous. Permeability is moderately slow, and runoff is very high. The available water capacity is very low. The hazard of wind erosion is moderate, and the hazard of water erosion is severe. Rough broken land is a source of large amounts of loamy sediment.

Included with this complex in mapping are small areas of Cottonwood soils near gypsum outcrops and soils that are similar to Quinlan soils but are less than 10 inches deep to sandstone. Yomont soils are on narrow footslopes and flood plains. The included soils make up about 18 percent of the map unit, but individual areas of the included soils are generally less than 10 acres.

All areas of this complex are used as rangeland. Forage production within the complex is highly variable. Areas of Rough broken land support little or no vegetation and other areas grow mid and tall grasses. However, these grassy areas are mostly inaccessible to livestock. Heavy and continuous grazing on the Woodward and Quinlan soils has allowed short grasses to replace the original tall grasses. Tall grasses are present in areas where grazing is light to moderate or inaccessible. The included Yomont soils on flood plains produce abundant cool-season grasses along with an occasional mott of trees. A dense cover of vegetation is needed to help slow the geological erosion.

The soils in this complex are not suited to cultivation. Shallow depth to bedrock, exposed bedrock, steep slopes, and erosion are the main limitations and hazards.

The Woodward soil part of this complex is moderately suited to habitat for both openland and rangeland wildlife. The Quinlan soil and the Rough broken land parts are poorly suited to habitat for openland and rangeland wildlife. The included Yomont soils are well suited for both openland and rangeland wildlife habitat.

The Woodward and Quinlan soils are in capability subclass 6e and the Loamy Prairie ecological site.

The Rough broken land is in capability subclass 7e and is in the Rough Breaks ecological site.

YmA—Yomont very fine sandy loam, 0 to 1 percent slopes, occasionally flooded

This very deep, well drained, nearly level soil is on flood plains. It is on slightly higher positions above the recent flood plain. Very brief flooding occurs once every 5 to 10 years. Areas are elongated to irregular and range from 8 to 40 acres.

Typically, the surface layer is reddish brown very fine sandy loam to about 8 inches. The underlying material is yellowish red very fine sandy loam to a depth of 80 inches and contains strata of silt loam.

The Yomont soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderately rapid, and runoff is negligible. The available water capacity is high. The surface layer is very friable and easily worked through a wide range of soil moisture conditions. Root development is not restricted. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included with this soil in mapping are a few small areas of Westola soils on ridges and Wheatwood soils in low areas. Small areas of frequently flooded Yomont soils adjacent to stream channels are also included. The included soils make up about 10 percent of the map unit. Individual areas of the soils are less than 8 acres.

This Yomont soil is mostly used as rangeland. The production of native forage species is high where there is adequate management. This soil is an excellent provider of early cool-season grasses. Brush management along with deferred grazing hastens range improvement where there is an excessive growth of brush species and some climax grasses are present.

Some areas of this Yomont soil are used for growing cultivated crops. Cotton, sorghums, and small grains are commonly grown. Cultivated areas are subject to occasional very brief flooding. The hazard of soil blowing is a major concern. Minimum tillage, winter cover crops, and residue management help reduce soil erosion, maintain organic matter content, and improve fertility and tilth.

The soil is well suited to habitat for openland wildlife and rangeland wildlife.

The soil is in capability subclass 3e. It is in the Loamy Bottomland ecological site.

YtA—Yomont very fine sandy loam, 0 to 1 percent slopes, frequently flooded

This very deep, well drained, nearly level soil is on flood plains that border major drainageways. This soil is very briefly flooded one or more times every 2 years. Areas are long and narrow and range from 15 to 300 acres.

Typically, the surface layer is reddish brown very fine sandy loam about 10 inches thick. The underlying material is reddish brown very fine sandy loam stratified with thin layers of loamy very fine sand, fine sandy loam, and silt loam to a depth of 80 inches.

The Yomont soil has medium natural fertility and organic matter content. The soil is moderately alkaline and calcareous throughout. Permeability is moderately rapid, and surface runoff is negligible. The soil absorbs water readily. The available water capacity is high. Root development is not restricted. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included with this soil in mapping are a few small areas of Lincoln and Westola soils on ridges and low-lying areas near the stream channel. Also included are a few occasionally flooded areas of Yomont soils in higher positions near uplands. The included soils make up as much as 20 percent of the map unit. Individual areas of the soils are generally less than 8 acres.

Because of frequent flooding, areas of this soil are used as rangeland. Production of native forages is high where management is good and some climax species are present. The flooding adds plant nutrients. Most areas of this soil produce a variety of early cool-season grasses. Brush management is advantageous in areas that have an excessive growth of woody vegetation.

The soil is moderately suited to habitat for openland wildlife and rangeland wildlife.

This soil is in capability subclass 5w. It is in the Loamy Bottomland ecological site.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slopes range mainly from 0 to 5 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 174,500 acres, or nearly 30 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available. Some soils that do not have adequate available water capacity qualify as prime farmland only in areas where this limitation can be overcome by irrigation. The need for irrigation is indicated after the map unit name.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

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 to prevent 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 behavioral 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 and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational 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.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited*, and *very limited*. The suitability ratings are expressed as *well suited, moderately suited, poorly suited*, and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Crops and Pasture

Bobby K. Hanna, Agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained. The estimated yields of the main crops and hay and pasture plants are listed.

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

King County has about 56,500 acres of cropland (USDA, 1992 and 1997), which makes up about 10 percent of the county. In 1997, only 22,200 acres, or about 4 percent of the county, was cultivated. The main crops are wheat, cotton, and forage sorghum. Oats, rye, vetch, grain sorghum, and melons are also grown. Grass and legume seed are sometimes produced from kleingrass, switchgrass, introduced bluestems, and vetch.

Field crops suited to the soils and climate of the survey area include some that are not commonly grown. Peanuts, gaura, corn, sunflowers, castor beans, mung beans, barley, alfalfa, millet, sesame, and similar crops can be grown if economic conditions are favorable.

The very deep, loamy and well drained Carey, Enterprise, Grandfield, and Miles soils are especially suited to growing truck crops where slopes are less than 3 percent. These soils are also suited to growing small and large fruits, nuts, grapes, and nursery plants. Production is limited mainly by the amount of rainfall or the availability of irrigation water.

The very deep, loamy soils on flood plains are usually well suited to growing truck crops, nuts, and horticultural crops. In certain areas, the danger of flooding and the concentration of cold air are major concerns.

The potential of the soils in King County for increased production of food and fiber is good. Many of the soils that have good potential for cropland are currently used as rangeland. In addition to the reserve production capacity represented by this acreage, food and fiber production could be increased considerably by applying the latest crop production technology to all of the cropland in the county. Information provided in this soil survey can greatly facilitate the application of such technology.

Conversion of marginal cropland and some rangeland to pastureland and hayland is a trend that has continued in King County during the past several years. Land that is used for pasture and hay production is generally planted to introduced grasses that respond well to proper management; and if they are managed properly, these areas will not have a problem with erosion. The pastures are used mainly to provide year-long grazing in combination with native rangeland.

The most important grasses, both native and introduced, are improved species of bermudagrass, kleingrass, switchgrass, indiangrass, and several varieties of old world bluestems. An interest is also being shown in seeding tall wheatgrass and other improved varieties of cool-season grasses on sites where they are adapted.

Improved bermudagrasses, switchgrass, and kleingrass are better suited to very deep soils on bottom lands, such as Westola, Wheatwood, and Yomont, than to other soils in the county. However, these grasses are adapted to most of the soils where a good seedbed can be prepared. Soils such as Obaro, Tilvern, Vernon, and Woodward are not very well suited to bermudagrass and switchgrass because of the lower available water capacity of these soils. Drought-resistant grasses, such as certain species of old world bluestems, are better adapted to these soils as well as other droughty soils, such as Beckman, Foursixes, Knoco, and Quinlan.

Good management practices for pastureland include nutrient management, prescribed grazing, pest management, brush management, and an adequate water supply. Good management practices for hayland include nutrient management, pest management, and forage harvest management.

Erosion Control

Water erosion is a major concern in nearly all of the large areas of cropland and on smaller cropland fields that have a slope of more than 1 percent. It reduces productivity, especially when the surface layer is so thin that it is mixed with the less fertile subsoil during cultivation. The subsoil is low in organic matter and in some places, it contains undesirable salts. When this subsoil is mixed with topsoil, it causes a dense crust to form on the surface. This reduces the ability of air and moisture to enter the soil and hinders the emergence of crop seedlings.

Erosion is especially damaging on soils that are moderately deep to bedrock, such as Vernon, Obaro, and Woodward. As erosion reduces the thickness of these soils, the rooting zone becomes more restricted, and their ability to store moisture for plant use is reduced.

Soil loss by water erosion results in sedimentation of streams, ponds, and lakes. Control of erosion minimizes sedimentation and improves the quality of water for municipal use, recreation, and for fish and wildlife.

Cropping systems should be designed so that they hold soil losses by erosion to a minimal amount in order that productive capacity will be maintained indefinitely. Farming practices that help to control water erosion are those that provide a protective surface cover, reduce the amount and rate of runoff, and increase the rate of water infiltration.

The management of crop residues is the best method of protecting the soil surface. The residues will also help to reduce runoff. Reduced tillage systems that leave a maximum amount of crop residue on the surface will provide the protective cover needed. Delaying seedbed preparation for as long as possible will extend the length of time that residue is on the surface. Protecting residue from grazing and burning is necessary for maximum effectiveness.

Terraces and diversions help control erosion by reducing the length of slope, which slows runoff. They also serve as guidelines for contour farming. Nearly all of the farmed soils in King County are suitable for terraces. Terracing and contour farming increase the rate of water infiltration; thereby increasing crop yields when moisture is limited. Establishing protective grassed waterways to remove excess runoff from terraces and diversions is essential to prevent the formation of gullies.

Wind erosion is a hazard during periods of drought and during windstorms that occur during the critical wind erosion period of November 1 to June 1. The soils affected by wind erosion are the sandy Delwin, Devol, Grandfield, and Nobscot soils and the loamy Enterprise, Grandfield, Hardeman, Miles, Shrewder, and Woodward soils.

Some crops, such as cotton, do not produce adequate residues to protect these soils from blowing during the critical wind erosion period. Rotation of cotton with wheat and sorghums will increase the amount of residue that can be left on the soil surface. Soils left bare and smooth can be damaged in a few hours if winds are strong. Maintaining a vegetative cover or keeping a bare surface rough with tillage are other methods of reducing erosion by wind. Cover crops commonly used during the cool season include small grains, such as wheat, rye, and oats, and legumes, such as Austrian winterpeas and vetch. The legumes protect the soil from wind and water erosion, provide high quality grazing, and add nitrogen to the soil.

More specific information on erosion control practices that can be used on each kind of soil can be obtained at the local office of the Natural Resources Conservation Service.

Soil Fertility and Tilth

Fertility is naturally high in a flood plain soil, such as Wheatwood. Many of the dark colored soils on uplands, such as Carey, Frankirk, Kingco, St. Paul, and Westill soils, are also high in natural fertility. The light colored fine sandy loam soils on uplands are medium in natural fertility. These include such soils as Enterprise, Grandfield, Hardeman, and Miles. Most of the soils in the county will benefit from the addition of nitrogen, phosphorous, and potassium. No soil in King County is acidic enough that it would benefit from the addition of lime. On all soils, the amount and type of fertilizer application should be based on the results of soil tests, crop needs, the expected level of production, the previous land use or cropping sequence, and the amount of available soil moisture. The local office of the Natural Resources Conservation Service or Texas Cooperative Extension can furnish the latest information on the kinds and amounts of fertilizer to apply, and they can provide assistance in obtaining a soil test.

Soil tilth is an important factor in the germination of seeds and in the infiltration of moisture into the soil. Soils with good tilth are granular, porous, and friable. Tilth can be improved by adding large amounts of organic matter, leaving crop residues on or near the soil surface, and reducing the number of tillage operations. Soils such as Kingco, St. Paul, and Westill tend to have moderate amounts of organic matter and good structure. However, these soils tend to be cloddy if plowed when it is too wet or too dry. Good seedbeds are difficult to prepare in cloddy field conditions. Plowing when it is too wet may cause a plowpan to form, and grazing during wet conditions severely damages the soil structure and causes a dense crust to form. Both of these conditions impede the downward movement of plant roots, air, and moisture and causes runoff to increase. Fall plowing results in good tilth for the spring, but wind and water erosion will usually occur if the soil is left bare of vegetation.

Soils that have a light colored surface layer of sand, loamy sand, fine sand, or very fine sandy loam usually have a low content of organic matter. Generally, the structure of these soils is poor, and they tend to form a thick surface crust after an intense rainfall. The thick crust contains sand grains on the surface which are easily detached by wind. The crust also reduces infiltration and increases runoff. Emerging plant seedlings are often unable to penetrate the thick crust. Regular additions of crop residue, manure, and other organic material, such as cotton burs, can improve soil structure and soil tilth and reduce crust formation and soil blowing. Growing legumes can also improve the soil in this way.

Soil Moisture

Inadequate soil moisture is the most limiting factor for crop production in King County. Although average yearly rainfall is generally adequate for most crops, short periods of drought are common during the growing season. In some years droughts last more than 3 months. The most severe conditions usually occur during the period of middle June to early July when dry, hot air from the desert southwest replaces the humid air flow from the south and southeast. As temperatures reach or exceed 100 degrees F, crops begin to wilt. This problem is more severe in soils such as Frankirk, Kingco, Tilvern, and Westill. Although these soils are deep or very deep and have a moderate or high available water holding capacity, they also have a clayey subsoil with poor structure. This restricts the movement of water to the roots and makes it difficult for roots to penetrate the soil. Crops are unable to obtain all of their water requirements under these conditions.

Other climate factors that may limit crop production are flooding, high winds, occasional hailstorms, and high-intensity rains.

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 land capability classification of each map unit also is shown in the table.

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 ensures 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 Natural Resources Conservation Service or of Texas Cooperative Extension can provide information about the management and productivity of the soils for those crops.

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 criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation.

Class 7 soils have very severe limitations that make them unsuitable for cultivation.

Class 8 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, 2e. The letter *e* shows that the main hazard is the 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 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s*, or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6.

Agricultural Waste Management

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

Table 7, Table 8, and Table 9 described in this section show the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of these tables, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings in the tables are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops (application of manure and food-processing waste, application of sewage sludge, and disposal of wastewater by irrigation) and for waste management systems that are designed only for the purpose of wastewater disposal and treatment (overland flow of wastewater, rapid infiltration of wastewater, and slow rate treatment of wastewater).

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are either solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

Overland flow of wastewater is a process in which wastewater is applied to the upper reaches of sloped land and allowed to flow across vegetated surfaces, sometimes called terraces, to runoff-collection ditches. The length of the run generally is 150 to 300 feet. The application rate ranges from 2.5 to 16.0 inches per week. It commonly exceeds the rate needed for irrigation of cropland. The wastewater leaves solids and nutrients on the vegetated surfaces as it flows downslope in a thin film. Most of the water reaches the collection ditch, some is lost through evapotranspiration, and a small amount may percolate to the ground water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, and the design and construction of the system. Reaction and the cation-exchange capacity affect absorption. Reaction, salinity, and the sodium adsorption ratio affect plant growth and microbial activity. Slope, permeability, depth to a water table, ponding, flooding, depth to bedrock or a cemented pan, stones, and cobbles affect design and construction. Permanently frozen soils are unsuitable for waste treatment.

Rapid infiltration of wastewater is a process in which wastewater applied in a level basin at a rate of 4 to 120 inches per week percolates through the soil. The wastewater may eventually reach the ground water. The application rate commonly exceeds the rate needed for irrigation of cropland. Vegetation is not a necessary part of the treatment; hence, the basins may or may not be vegetated. The thickness of the soil material needed for proper treatment of the wastewater is more than 72 inches. As a result, geologic and hydrologic investigation is needed to ensure proper design and performance and to determine the risk of ground-water pollution.

The ratings in the table are based on the soil properties that affect the risk of pollution and the design, construction, and performance of the system. Depth to a water table, ponding, flooding, and depth to bedrock or a cemented pan affect the risk of pollution and the design and construction of the system. Slope, stones, and cobbles also affect design and construction. Permeability and reaction affect performance. Permanently frozen soils are unsuitable for waste treatment.

Slow rate treatment of wastewater is a process in which wastewater is applied to land at a rate normally between 0.5 inch and 4.0 inches per week. The application rate commonly exceeds the rate needed for irrigation of cropland. The applied wastewater is treated as it moves through the soil. Much of the treated water may percolate to the ground water, and some enters the atmosphere through evapotranspiration. The applied water generally is not allowed to run off the surface. Waterlogging is prevented either through control of the application rate or through the use of tile drains, or both.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, and the application of waste. The properties that affect absorption include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, depth to bedrock or a cemented pan, reaction, the cation-exchange capacity, and slope. Reaction, the sodium adsorption ratio, salinity, and bulk density affect plant growth and microbial activity. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood of wind erosion or water erosion. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Rangeland

Reginald D. Quiett, range conservationist, Natural Resources Conservation Service, assisted with the preparation of this section.

About 90 percent of King County is rangeland. King County has deep roots in ranching heritage and has many well-known ranches. Cow-calf is the dominant livestock operation with some stocker operations.

Continued excessive use and the elimination of fire have depleted the native vegetation in much of the county. Much of the acreage that once was open grassland is now covered with brush. Mesquite and redberry juniper have invaded the entire county, and these species use gallons of water that could be used by more desirable plant species. The amount of grass forage produced currently may be less than half of that originally produced. Using management practices that are effective for specific kinds of soils and ecological sites can increase productivity of the rangeland.

Some livestock operations supplement grazing of rangeland with improved pasture and forage crops. Old world bluestems and weeping lovegrass sometimes complement native rangeland. Small grains and forage sorghums can provide extra grazing.

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 10 shows, for each soil that supports rangeland vegetation, the ecological site and the potential annual production of vegetation in favorable, normal, and unfavorable years. An explanation of the column headings in Table 10 follows.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff, which has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of a site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided at the end of this section and in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service.

Total dry-weight 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. Yields are adjusted to a common percent of air-dry moisture content.

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 similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in chapter 4 of the "National Range and Pasture Handbook" (http://www.ftw.nrcs.usda.gov/glti/NRPH.html).

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, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential or climax community are re-established. Managing brush is an important management concern. Proper stocking and providing adequate rest periods are vitally important for rangeland improvement. If sound rangeland management based on soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of the rangeland in the county.

Good production of livestock and forage on rangeland is obtained primarily by managing the time of grazing and limiting the amount of forage removed. The green parts of plants manufacture food for growth and store part of it for use in re-growth and seed production. Management practices that permit this process to take place are discussed below.

Proper Grazing Use. The objective of this practice is to graze at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity of desirable vegetation.

Deferred Grazing. This is the deferment or restriction of grazing until the better forage plants have completed most of their seasonal growth or have made seed. It helps keep the desirable plants healthy and vigorous and permits plants that have been depleted to recover. Deferred grazing helps to improve plant cover and reduce soil erosion.

Fencing. This practice excludes livestock from areas that should be protected from grazing, confines livestock to an area, subdivides grazing land to permit use of planned grazing systems, and protects new seedlings or plantings from grazing.

Prescribed Burning. Livestock operators and wildlife managers use this practice to periodically remove or reduce a dense cover of mature vegetation. When done properly and at the right time, this practice will stimulate new, succulent growth; help to restore climax plant species; and reduce infestations of noxious weeds and brush. However, desirable plants can be severely damaged or killed if the soil surface is too dry, allowing the fire to reach the plant crowns and roots. Burning is not recommended more often than once every three years, since doing so may harm perennial grass vegetation. Prescribed burning is an effective management tool that can be substituted for chemical or mechanical treatments in many plant communities.

Planned Grazing Systems. The objective of this practice is to rotate the grazing of livestock through two or more pastures in a planned sequence for a specified period of time. A planned grazing system may be relatively simple in design using two pastures, or may be more complex and management intensive, using one or two herds and many pastures. To be successful, it must be tailored to conditions existing in each ranch unit and meet the needs of the plants and animals as well as the rancher.

A typical growth curve for native vegetation representing the percentage of total growth occurring each month would be:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	2	3	7	20	30	15	5	10	4	2	1

Approximately 65 percent of the annual production of forage occurs in the months of May through July responding to typical spring and early summer rains. A second smaller growth period may occur in the fall if sufficient moisture is available.

Clay Loam Ecological Site

The Foursixes, Kingco, Nipsum, St. Paul, and Westill soils are in this site (fig. 14.) The climax plant community is a mid and short grass site with scattered browse, forbs, and woody plants (fig. 15). The composition by weight is about 95 percent grasses, 5 percent forbs and only a trace amount of woody plants.

The climax vegetation consisted of about 10 percent blue grama; 15 percent buffalograss; 20 percent sideoats grama; 10 percent vine mesquite; 15 percent tobosa; 5 percent Arizona cottontop; 5 percent Texas wintergrass; 5 percent western wheatgrass; and 10 percent other grasses. The 5 percent forb composition consisted of dotted gayfeather, heath aster, greenthread, trailing ratany, western ragweed, verbena, skeletonplant, and bindweed. The trace amount of woody plant composition consisted of hackberry, lotebush, agarito, and ephedra.

If regression occurs as a result of heavy grazing, buffalograss and tobosa become dominant. Continued heavy grazing and lack of periodic fire result in a plant community dominated by red grama, threeawn, and hairy tridens with a rapid increase in mesquite and pricklypear.

Gyp Ecological Site

The Cottonwood soil is in this site. The climax plant community is a mid and tall grass site dominated by sideoats grama and little bluestem. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 20 percent sideoats grama; 25 percent little bluestem; 10 percent sand bluestem; 5 percent indiangrass; 10 percent blue grama and buffalograss; 5 percent tobosa; 5 percent threeawn; and 5 percent other grasses. The 10 percent forb composition consisted of wild buckwheat, greenthread, goldaster, dotted gayfeather, plains blackfoot, plains zinnia, heath aster, verbena, and trailing ratany. The 5 percent woody composition consisted of redberry juniper, skunkbush, littleleaf sumac, elbowbush, feather dalea, ephedra, saltbush, acacia, hackberry, and lotebush.

If regression occurs as a result of heavy grazing, the tall grasses are replaced by buffalograss, threeawn, hairy grama, and rough tridens. Continued heavy grazing and lack of periodic fire result in a plant community of redberry juniper, pricklypear, and mesquite with juniper being the most prominent.

Lakebed Ecological Site

The Lazare soil is in this site. The climax plant community is a mid and short grass site. Forbs and sedges typically dominate sites inundated for long periods of time. The composition by weight is about 85 percent grasses and sedges and 15 percent forbs.

The climax vegetation consisted of about 50 percent vine mesquite and buffalograss; 20 percent white tridens and sedges; 10 percent knotgrass; and 5 percent annual grasses. The 15 percent forb composition consisted of coneflower, frog fruit, primroses, and many annuals.

This site is a preferred site by livestock and receives heavy use almost all the time due to it receiving and holding extra moisture. Without periodic rest periods, this site will regress to a primarily annual plant community and bare ground.

Loamy Ecological Site

The Acme, Aspermont, Jaywi, and Quanah soils are in this site (fig. 16). The climax plant community is a mid and short grass site dominated by sideoats grama. The composition by weight is about 90 percent grasses, 10 percent forbs, and just a trace amount of woody plants.

The climax vegetation consisted of about 25 percent sideoats grama; 15 percent blue grama and buffalograss; 10 percent sand bluestem; 15 percent little bluestem; 5 percent indiangrass; 5 percent switchgrass; and 15 percent other grasses. The 10 percent forb composition consisted of Engelmann daisy, heath aster, rockdaisy, verbena, dotted gayfeather, trailing wildbean, skeletonplant, plains zinnia, and catclaw sensitivebriar. The

Figure 14.—Antelope prefer open spaces. This area of Westill clay loam, 0 to 1 percent slopes, is in the Clay Loam ecological site.

Figure 15.—Aerial spraying was used to control mesquite on this Clay Loam ecological site. The soil is Westill clay loam, 0 to 1 percent slopes.

Figure 16.—Mesquite is re-invading an area of Quanah silty clay loam, 1 to 3 percent slopes. This soil formed in valley fill sediments and is in the Loamy ecological site. Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes, is mapped on the more sloping areas and hills.

trace amount of woody plant composition consisted of littleleaf sumac, hackberry, saltbush, dalea, acacia, and yucca.

If regression occurs as a result of heavy grazing, blue grama, buffalograss, and silver bluestem replace sideoats grama initially. Continued heavy grazing and lack of periodic fire result in a plant community dominated by threeawn, annual grasses, mesquite, broom snakeweed, and prickly pear.

Loamy Bottomland Ecological Site

The Westola, Wheatwood, and Yomont soils are in this site. The climax plant community is a tall and mid grass site. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 25 percent sand bluestem; 15 percent indiangrass; 15 percent switchgrass; 10 percent little bluestem; 5 percent sideoats grama; 5 percent Canada wildrye; and 10 percent other grasses. The 10 percent forb composition consisted of Engelmann daisy, Maximilian sunflower, sagewort, heath aster, verbena, greenthread, gaura, spiderwort, sedges, and coneflower. The 5 percent woody plant composition consisted of hackberry, wild plum, cottonwood, bumelia, saltbush, ephedra, soapberry, and wolfberry.

If regression occurs as a result of heavy grazing, the tall grasses are initially replaced by mid and short grasses with a significant increase in buffalograss and tobosa. Continued heavy grazing and lack of periodic fire result in a plant community dominated by red grama, hairy tridens, threeawn, mesquite, lotebush, and pricklypear.

Loamy Prairie Ecological Site

The Carey, Frankirk, Obaro, Paducah, Quinlan, and Woodward soils are in this site. The climax plant community is a mid and short grass site dominated by blue grama and buffalograss. The composition by weight is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 35 percent blue grama and buffalograss; 15 percent sideoats grama; 20 percent plains bristlegrass, Arizona cottontop, vine mesquite, and little bluestem; 15 percent silver bluestem, sand dropseed, hooded windmillgrass, hairy grama, and threeawn; and 5 percent Texas wintergrass, Canada wildrye, Hall panicum, and fall witchgrass. The 5 percent forb composition consisted of wild buckwheat, Maximilian sunflower, dotted gayfeather, Engelmann daisy, bundleflower, sagewort, sensitivebriar, trailing ratany, heath aster, and halfshrub sundrop. The 5 percent woody vegetation consisted of agarito, vine ephedra, wolfberry, littleleaf sumac, catclaw acacia, juniper, bumelia, skunkbush, hackberry, and yucca.

If regression occurs as a result of heavy grazing, buffalograss replaces blue grama and sideoats grama initially. Continued heavy grazing and lack of periodic fire result in a plant community dominated by threeawn, sand dropseed, hairy tridens, red grama, mesquite, juniper, pricklypear, and yucca.

Loamy Sand Prairie Ecological Site

The Devol and Grandfield loamy sands are in this site. The climax plant community is a tall grass prairie with scattered motts of oak. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 40 percent sand bluestem, switchgrass, and indiangrass; 10 percent little bluestem; 10 percent sideoats grama; 15 percent plains bristlegrass, Arizona cottontop, and sand lovegrass; and 10 percent hooded windmillgrass, Texas bluegrass, Canada wildrye, sand paspalum, Scribner panicum, sand dropseed, and threeawn. The 10 percent forb composition consisted of Engelmann daisy, primroses, gaura, dotted gayfeather, sagewort, verbena, western ragweed, heath aster, dayflower, mentzelia, wooly-white, trailing wildbean, and partridge pea. The 5 percent woody plant composition consisted of hackberry, sand sagebrush, skunkbush, littleleaf sumac, prickly ash, shinnery oak, yucca, and elbowbush.

If regression occurs as a result of heavy grazing, the tall grasses are grazed out and hooded windmillgrass, fall witchgrass, sand dropseed, fringed signalgrass, and sand paspalum become significant producers. Continued heavy grazing and lack of periodic fire result in heavy stands of sand sagebrush, mesquite, and shinnery oak.

Rocky Hill Ecological Site

The bouldery clay Knoco soils in the Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes, are in this site (fig. 17). The climax plant community is a tall and mid grass community with little bluestem, sand bluestem, and sideoats grama dominating. The north and east exposures of this site are cooler and wetter; therefore, these slopes are more productive. Slopes of 12 to 20 percent limit livestock management and slopes of greater than 20 percent should not be figured into a forage inventory due to inaccessibility. The composition by weight is about 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

The climax vegetation consisted of about 20 percent sideoats grama; 20 percent sand bluestem; 10 percent indiangrass; 25 percent little bluestem; 5 percent Canada wildrye; and 5 percent other perennial grasses. The 5 percent forb composition consisted of Mexican sagewort, heath aster, Engelmann daisy, dotted gayfeather, trailing ratany, plains blackfoot, gray goldaster, and bigtop dalea. The 10 percent woody plant composition consisted of skunkbush, littleleaf sumac, feather dalea, hackberry, lotebush, yucca, plum, flameleaf sumac, ephedra, catclaw acacia, and agarito.

Figure 17.—Chaining was used to control redberry juniper in an area of Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes. The Talpa soils are in the Very Shallow ecological site and the Knoco soils are in the Rocky Hill ecological sites.

If regression occurs as a result of heavy grazing, sand bluestem and indiangrass decrease and little bluestem, sideoats grama, and silver bluestem increase initially. Continued heavy grazing and lack of periodic fire lead to a plant community dominated by buffalograss, Texas wintergrass, slim and rough tridens, threeawn, Texas grama, and annual forbs. Woody plants also increase as regression occurs.

Rough Breaks Ecological Site

The Rough broken land component of the Woodward-Quinlan-Rough broken land complex, 5 to 45 percent slopes, map unit is in this site. The climax plant community is highly variable due to differences in soil material, slope, exposure, and degree of geologic erosion. Sideoats grama and little bluestem are the dominant species. The composition by weight is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 25 percent sideoats grama; 20 percent little bluestem; 10 percent sand bluestem and indiangrass; 10 percent blue grama and buffalograss; 20 percent black grama, vine mesquite, slim tridens, and silver bluestem; and 5 percent threeawn and sand dropseed. The 5 percent forb composition consisted of dotted gayfeather, wild buckwheat, sagewort, gaura, heath aster, greenthread, scurfpea, plains blackfoot, and skeletonplant. The 5 percent woody composition consisted of feather dalea, redberry juniper, catclaw acacia, skunkbush, hackberry, vine ephedra, and littleleaf sumac.

This site generally has a higher rangeland similarity index due to inaccessibility to livestock. With a lack of periodic fire, mesquite and juniper will readily invade. Removal of vegetation cover can result in severe erosion. Mesa areas are either overgrazed or under used depending on accessibility.

Saline Bottomland Ecological Site

The Beckman soil is in this site. The climax plant community is a mid grass site dominated by alkali sacaton. The composition by weight is about 95 percent grasses and 5 percent forbs.

The climax vegetation consisted of about 55 percent alkali sacaton; 5 percent inland saltgrass; 5 percent switchgrass; 5 percent tall dropseed; 5 percent vine mesquite; 5 percent western wheatgrass; 15 percent other perennial grasses; and 5 percent forbs.

If regression occurs as a result of heavy grazing, the plant community will turn to almost 100 percent alkali sacaton with the invasion of a few mesquite trees.

Sand Hills Ecological Site

The Jester soil is in this site. The climax plant community is a tall grass site dominated by sand bluestem, little bluestem, giant sandreed, giant dropseed, and switchgrass. The composition by weight is about 80 percent grasses, 10 percent forbs, and 10 percent woody plants.

The climax vegetation consisted of about 20 percent sand bluestem; 10 percent switchgrass; 10 percent giant sandreed; 15 percent little bluestem; 5 percent sand lovegrass; 5 percent giant dropseed; 5 percent Canada wildrye; and 10 percent other perennial grasses. The 10 percent forb composition consisted of partridge pea, trailing wildbean, mentzelia, erect dayflower, queen's delight, evening primrose, morning glory, and tick clover. The 10 percent woody plant composition consisted of skunkbush, sand sagebrush, yucca, hackberry, and wild plum.

If regression occurs as a result of heavy grazing, the tall grasses give way to an increase in little bluestem initially. Continued heavy grazing will lead to a plant community of red lovegrass, tumble lovegrass, western ragweed, sand sagebrush, wild plum, and camphorweed. If the sandy surface layer is subject to wind erosion due to lack of adequate cover, vegetation is very difficult to re-establish.

Sandy Ecological Site

The Delwin and Nobscot soils are in this site. The climax plant community is a tall grass prairie interspersed with motts of shinnery oak. The composition by weight is about 75 percent grasses, 5 percent forbs, and 20 percent woody plants.

The climax vegetation consisted of about 40 percent sand bluestem, indiangrass, and switchgrass; 15 percent little bluestem; 10 percent sand lovegrass and giant dropseed; 5 percent plains bristlegrass and Arizona cottontop; and 5 percent Scribner panicum and sand paspalum. The 5 percent forb composition consisted of western ragweed, primroses, gaura, mentzelia, dayflower, woolly-white, trailing wildbean, and globemallow. The 20 percent woody plant composition consisted of about 15 percent shinnery oak and 5 percent hackberry, skunkbush, littleleaf sumac, wild plum, sand sagebrush, prairie acacia, bumelia, and prickly ash.

If regression occurs as a result of heavy grazing, dropseed and threeawn replace the tall grasses. Continued heavy grazing and lack of periodic fires result in a plant community of red lovegrass, gummy lovegrass, tumble lovegrass, numerous annuals, and a rapid spread of shinnery oak that may eventually dominate the site.

Sandy Bottomland Ecological Site

The Lincoln soil is in this site. The climax plant community is a tall grass site, which also produces a variety of forbs and browse. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 15 percent switchgrass; 15 percent indiangrass; 25 percent sand bluestem; 10 percent little bluestem; 5 percent threeawn; and 15 percent sand lovegrass, giant sandreed, Canada wildrye, Texas bluegrass, and western wheatgrass. The 10 percent forb composition consisted of Maximilian sunflower, prairie clover, gaura, heath aster, sagewort, dayflower, trailing wildbean, bundleflower, verbena, and sensitivebriar. The 5 percent woody plant composition consisted of sand plum, bumelia, hackberry, skunkbush, elbowbush, ephedra, soapberry, baccharis, cottonwood, and prickly ash.

If regression occurs as a result of heavy grazing, the tall grasses are replaced by mid and short grasses initially with little bluestem dominating. Continued heavy grazing and lack of periodic fire result in dense thickets of saltcedar, baccharis, and mesquite with alkali sacaton, inland saltgrass, and seep muhly becoming dominant grasses along with bermudagrass where it has washed in along the river.

Sandy Loam Ecological Site

The Enterprise, Grandfield, Hardeman, Miles, and Shrewder soils are in this site. The climax plant community is a mid grass prairie with little bluestem and sideoats grama dominating. The composition by weight is about 95 percent grasses, 5 percent forbs, and just a trace amount of woody plants.

The climax vegetation consisted of about 20 percent sideoats grama; 15 percent little bluestem; 15 percent blue grama and buffalograss; 15 percent plains bristlegrass; 20 percent Arizona cottontop and vine mesquite; and 10 percent sand dropseed, hooded windmillgrass, and threeawn. The 5 percent forb composition consisted of primrose, trailing ratany, verbena, Engelmann daisy, gaura, sagewort, dotted gayfeather, western ragweed, heath aster, dayflower, gray goldaster, woolly-white, and scurfpea. The trace amount of woody composition consisted of yucca, hackberry, skunkbush, bumelia, catclaw acacia, and vine ephedra.

If regression occurs as a result of heavy grazing, buffalograss, threeawn, and silver bluestem replace sideoats grama and little bluestem initially. Continued heavy grazing and lack of periodic fires result in a plant community of low quality perennial and annual grasses with a significant increase in mesquite, pricklypear, yucca, redberry juniper, and lotebush.

Shallow Clay Ecological Site

The Tilvern and Vernon soils are in this site. The climax plant community is a short and mid grass site dominated by sideoats grama, blue grama, and buffalograss. The composition by weight is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 30 percent sideoats grama; 5 percent blue grama; 10 percent buffalograss; 10 percent tobosa; 5 percent vine mesquite; 5 percent threeawn; 5 percent silver bluestem; 5 percent Texas wintergrass; 5 percent slim tridens; and 10 percent other grasses. The 5 percent forb composition consisted of wild buckwheat, indian rushpea, gaura, dotted gayfeather, Engelmann daisy, scurfpea, bigtop dalea, greenthread, trailing ratany, and plains blackfoot. The 5 percent woody plant composition consisted of hackberry, saltbush, ephedra, wolfberry, catclaw acacia, yucca, and feather dalea.

If regression occurs as a result of heavy grazing, sideoats grama and alkali sacaton are replaced primarily by buffalograss. Continued heavy grazing and lack of periodic fire result in a plant community dominated by hairy tridens, Texas grama, hairy grama, threeawn, and a significant increase in mesquite, pricklypear, redberry juniper, and lotebush.

Very Shallow Ecological Site

The Talpa soils are in this site (fig. 18). The climax plant community is a mid and tall grass site dominated by little bluestem, sand bluestem, and sideoats grama. The

Figure 18.—In the foreground, these cattle are grazing on a Very Shallow ecological site in an area of Talpa gravelly loam, 1 to 5 percent slopes. In the background and below the Talpa soils is an area of Quanah silty clay loam, 1 to 3 percent slopes, which is in the Loamy ecological site.

composition by weight is about 95 percent grasses, 5 percent forbs, and just a trace amount of woody plants.

The climax vegetation consisted of about 35 percent sideoats grama; 15 percent little bluestem; 15 percent sand bluestem; 5 percent hairy grama; 5 percent buffalograss; 5 percent silver bluestem; 5 percent slim tridens; 5 percent threeawn; and 5 percent other grasses. The 5 percent forb composition consisted of plains blackfoot, dotted gayfeather, trailing ratany, catclaw sensitivebriar, Engelmann daisy, bigtop dalea, gray goldaster, sagewort, verbena, greenthread, bundleflower, and gaura. The trace amount of woody plant composition consisted of bush honeysuckle, littleleaf sumac, skunkbush, elbowbush, agarito, feather dalea, vine ephedra, hackberry, redberry juniper, catclaw acacia, and wild plum.

If regression occurs as a result of heavy grazing, the tall grasses give way and are replaced by little bluestem, silver bluestem, and slim tridens initially. Continued heavy grazing and lack of periodic fire leads to a dominance of triden, threeawn, dropseed, witchgrass, and hairy grama with redberry juniper and catclaw acacia dominating the site.

Very Shallow Clay Ecological Site

The nonstony Knoco soils are in this site. The climax plant community is a short and mid grass site dominated by sideoats grama. The composition by weight is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

The climax vegetation consisted of about 40 percent sideoats grama; 10 percent buffalograss; 5 percent alkali sacaton; 10 percent silver bluestem; 10 percent tobosa; 5 percent little bluestem and sand bluestem; and 10 percent other grasses. The 5 percent forb composition consisted of plains blackfoot, indian rushpea, western ragweed, dotted gayfeather, and catclaw sensitivebriar. The 5 percent woody plant composition consisted of lotebush, vine ephedra, saltbush, pricklypear, and tasajillo.

If regression occurs as a result of heavy grazing, sideoats grama is replaced by an increase in buffalograss. Continued heavy grazing and lack of periodic fire result in a plant community of threeawn, Texas grama, pricklypear, mesquite, redberry juniper, and lotebush.

Windbreaks and Environmental Plantings

Windbreaks protect cropland fields, 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 deciduous 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 from wind, help to keep snow on the fields, and provide food and cover for wildlife. Many times they are only part of a management system that includes cropping systems and crop residue management.

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 ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition. In King County preventing competition from weeds and providing supplemental water is usually needed for satisfactory plant establishment.

Table 11 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in Table 11 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 the local office of the Natural Resources Conservation Service, Texas Forest Service, or Texas Cooperative Extension.

Recreation

In Table 12 and Table 13 described in this section, the soils of the survey area are rated according to limitations that affect their suitability for recreational development. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables 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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

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

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 ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Playgrounds require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Paths and trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Off-road motorcycle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

Golf course fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

Wildlife Habitat

Charles Coffman, biologist, Natural Resources Conservation Service, helped prepare this section.

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 14, 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 created, 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 affects 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 flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat, oats, barley, grain sorghum, and millet.

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, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are kleingrass, lovegrass, blue panicum, yellow sweetclover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affects the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are switchgrass, sideoats grama, plains bristlegrass, Illinois bundleflower, and crotons.

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 white honeysuckle, shinnery oak, sand sagebrush, sumac, and native plum.

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, saltgrass, cattail, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas (fig. 19). Dams, levees, or other water-control structures create others. 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, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include blue and bobwhite quail, dove, meadowlark, field sparrow, cottontail, bluebird, and coyote

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, and raccoon.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, wild turkey, feral hogs, meadowlark, and lark bunting (fig. 20 and fig. 21).

Figure 19.—This shallow stream drains an area of Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes. This is a seasonal source of water for livestock and wildlife.

Figure 20.—These Gyp and Very Shallow Clay ecological sites were chained 3 years prior to this photograph. Deer and livestock have benefited from the new growth of brush and grass species. This area is part of the Cottonwood-Knoco complex, 3 to 20 percent slopes.

Figure 21.—Feral hogs compete with cattle on this Clay Loam ecological site. The soil is Westill clay loam, 0 to 1 percent slopes.

Engineering

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. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading "Soil Properties."

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 between the surface and a depth of 5 to 7 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 should 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 particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, 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 kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, reclamation material, roadfill, and topsoil; plan structures for water management; and 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

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 15 and Table 16 described in this section show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Table 17 and Table 18 show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

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. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, 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. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid 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. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

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 revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Construction Materials

Table 19 and Table 20 give information about the soils as potential sources of gravel, sand, reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

Gravel and *sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In Table 19, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good, fair*, or *poor* as potential sources of sand and gravel. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

In Table 20 the rating class terms are *good, fair*, and *poor*. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of reclamation material, roadfill, and topsoil. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

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 whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a 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 AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

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. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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 21, Table 22, and Table 23 give 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 ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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. Embankments that have zoned construction (core and shell) are not considered. 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.

Soil interpretations for *constructing grassed waterways and surface drains* evaluate soil limitations for systems that involve the removal of surface water from a site. The ratings are for soils in their natural condition and do not consider present land use.

Grassed waterways and surface drains are natural or engineered channels and drainage systems that remove excess surface water from agricultural land. Generally, grassed waterways are broad and shallow and are covered with erosion-resistant grasses. They are used to conduct surface water to outlets or surface drains at a non-erosive velocity. Surface drains are generally systems engineered to remove surface water accumulated by terraces or waterways through the installation of surface inlets and underground drainage lines leading to off-site surface outlets.

The soil properties and qualities that affect the construction and maintenance of grassed waterways and surface drains are large stones, wetness, slope, and depth to bedrock or cemented pan. The soil properties and qualities that affect the growth of grass after construction are moisture regime; susceptibility to wind or water erosion; available water capacity; rooting depth; presence of toxic substances, such as salts or sodium; and water and air permeability.

Soil interpretations for *constructing terraces and diversions* evaluate soil limitations for systems that involve the movement of surface water from a site. The ratings are for soils in their natural condition and do not consider present land use.

Terraces and diversions are embankments or a combination of an embankment and a channel constructed across a slope. They control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope. These structures are designed to convey surface water to stable outlets at a non-erosive velocity.

The soil properties and qualities that influence construction are slope, large stones, depth to bedrock or cemented pan, and wetness. Other properties and qualities that may cause problems after construction are restricted rooting depth, a high susceptibility to wind or water erosion, and restricted water and air permeability. A high content of gypsum may cause soil piping or pitting.

Soil interpretations for *irrigation all application methods* evaluate soil limitations for irrigation practices. The ratings are for soils in their natural condition and do not consider present land use.

Irrigation practices are used to provide supplemental water to crops, orchards, vineyards, and vegetables in areas where natural precipitation will not support the production of the crops being grown.

The soil properties and qualities important in design and management of an irrigation practice are sodium adsorption ratio, depth to a seasonal high water table, available water capacity, air and water permeability, wind erodibility, erosion factor, slope, and flooding. The soil properties and qualities that influence installation and tillage are stones, depth to bedrock or cemented pan, and depth to a seasonal high water table. The properties and qualities that affect performance of the irrigation system are depth to bedrock or cemented pan, bulk density, the sodium adsorption ratio, salinity, and soil reaction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

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 particle-size distribution, plasticity, and compaction characteristics.

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 to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

Engineering Soil Properties

Table 24 described in this section gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

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 mm across. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, 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 (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches across 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, CL-ML.

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 across is classified in one of seven groups from A-1 through A-7 on the basis of particle-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.

Rock fragments larger than 10 inches across and 3 to 10 inches across 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 across based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 mm, 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.

Physical Soil Properties

Table 25 described in this section shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

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

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 mm across. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (*K_{sat}*) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, 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 and septic tank absorption fields.

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 soil layer. The capacity varies, depending on soil properties that affect retention of water. 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.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 mm across.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. 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) and the Revised Universal Soil Loss Equation (RUSLE) 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 and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 mm in size.

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 susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook," which is available in local offices of the Natural Resources Conservation Service or on the Internet at http://soils.usda.gov/technical/handbook/.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Soil Properties

Table 26 described in this section shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil 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.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 mm in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 mm in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Water Features

Table 27 described in this section gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. The table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

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

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

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 little or no horizon development.

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.

Soil Features

Table 28 described in this section gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes 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 results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete 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 also is expressed as *low, moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of analyses of one pedon in the survey area are given in Table 29 and Table 30. The data are for a soil sampled at a carefully selected site. Soil samples were analyzed by the Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 mm across. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to methods published in Soil Survey Investigations Report 42 (USDA, 1991).

Sand—(0.05 to 2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

Silt—(0.002 to 0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).

Water content—pressure extraction, percentage of ovendry weight of less than 2 mm material; 1/3- or 1/10-bar (4B1), 15 bars (4B2a).

Bulk density—of less than 2 mm material, saran-coated clods field moist (4A5), 1/3-bar (4A1d), ovendry (4A1h).

Coefficient of linear extensibility—change in clod dimension based on whole soil (4D1).

Extractable bases—ammonium acetate pH 7.0; calcium (6N2i), magnesium (6O2H), sodium (6P2f), potassium (6Q2f).

Base saturation—ammonium acetate, pH 7.0 (5C1).

Reaction (pH)—1:1 water dilution (8C1f).

Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).
Exchangeable sodium percentage (5D2).
Carbonate as calcium carbonate—(fraction less than 2 mm [80 mesh]) manometric (6E1h).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(Soil Survey Staff, 1975 and 1992)*. 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. Table 31 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 Alfisol.

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 Ustalf (*Ust*, meaning limited moisture, plus *alf*, from Alfisol).

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; type of saturation; 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 Haplustalfs (*Hapl*, meaning minimal horizonation, plus *ustalf*, the suborder of the Alfisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. 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 Haplustalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, thermic Typic Haplustalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each 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" *(Soil Survey Division Staff, 1993)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(Soil Survey Staff, 1975)* and in "Keys to Soil Taxonomy" *(Soil Survey Staff, 1992)*. Unless otherwise indicated, 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."

Acme Series

The Acme series consists of very deep, well drained, nearly level, loamy soils on uplands. These soils weathered from materials high in gypsum. Permeability is moderate. Slopes are 0 to 1 percent. The soils of the Acme series are fine-silty, mixed, superactive, thermic Gypsic Calciustolls.

Acme soils commonly are on the landscape with Carey, Paducah, and St. Paul soils. Carey, Paducah, and St. Paul soils are more than 40 inches deep.

Typical pedon of Acme loam in an area of Acme loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 0.74 mile west on Farm Road 193, and 100 feet north of road in rangeland:

A—0 to 16 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable; many fine and medium roots; common worm channels and casts; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw—16 to 25 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate very fine and fine subangular blocky; hard, friable; common fine and medium roots; few fine pores; few worm channels and casts; common films, threads, and few fine concretions of calcium carbonate; about 1 percent films and threads of gypsum; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bky1—25 to 34 inches; mottled pink (5YR 7/3) and light reddish brown (5YR 6/4) gypsiferous loam, light reddish brown (5YR 6/3) and reddish brown (5YR 5/4) moist; strong coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; few fine roots; few fine pores; coatings of calcium carbonate and gypsum on prism faces; about 25 percent powdery and crystalline masses of gypsum; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Bky2—34 to 51 inches; mottled light reddish brown (5YR 6/4) and pink (5YR 7/3) gypsiferous loam; reddish brown (5YR 5/3) and light reddish brown (5YR 6/3) moist; strong coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few fine roots; few fine pores; coatings of calcium carbonate and gypsum on prism faces; about 35 percent masses and brownish opaque crystals of gypsum; about 8 percent soft masses of calcium carbonate; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Bky3—51 to 80 inches; light brown (7.5YR 6/4) gypsiferous loam, brown (7.5YR 5/4) moist; common fine distinct light gray (2.5Y 7/2) mottles, light brownish gray (2.5Y 6/2) moist; strong coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few fine pores; coatings of calcium carbonate and gypsum on prism faces; about 30 percent masses and brown opaque crystals of gypsum; about 5 percent fine and medium masses of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum is 60 to more than 80 inches. Clay content in the particle-size control section ranges from 18 to 30 percent.

The A horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 2 or 3. The horizon ranges from very slightly effervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. Texture is loam, silt loam, or silty clay loam. Content of gypsum ranges from 0 to 3 percent. Content of calcium carbonate ranges from 1 to 5 percent. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

The Bky horizon has hue of 5YR to 10YR, value of 6 to 8, and chroma of 1 to 8. Texture is gypsiferous loam, gypsiferous silt loam, or gypsiferous silty clay loam. Content of gypsum ranges from 20 to 60 percent and includes as much as 20 percent selenite crystals. Prism faces contain thick coatings of secondary calcium carbonate mixed with gypsum. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

Aspermont Series

The Aspermont series consists of deep, well drained, gently sloping soils on uplands. These soils formed in calcareous loamy material overlying silty and clayey Permian age red beds. Permeability is moderate. Slopes range from 2 to 5 percent. The soils of the Aspermont series are fine-silty, mixed, active, thermic Typic Calciustepts.

Aspermont soils are commonly on the landscape with Cottonwood, Knoco, Quanah, Talpa, Tilvern, Vernon, and Westill soils. Cottonwood, Knoco, and Talpa soils are less than 20 inches in depth. Quanah soils have a mollic epipedon. Tilvern, Vernon, and Westill soils have more than 35 percent clay in the particle-size control section.

Typical pedon of Aspermont silty clay loam in an area of Aspermont silty clay loam, 2 to 5 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83; 2.1 miles east on Farm Road 3416, 0.9 mile south and 1,000 feet southeast on county road, and 40 feet north in rangeland:

A—0 to 6 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 4/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, firm; common fine and medium roots; few fine pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—6 to 22 inches; yellowish red (5YR 4/6) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; hard, firm; few fine and medium roots; few fine pores; few worm channels and casts; common fine and medium concretions of calcium carbonate; few pitted concretions of calcium carbonate as much as 1 cm across; about 13 percent calcium carbonate equivalent; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—22 to 33 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine roots; few fine pores; about 15 percent masses of calcium carbonate; common concretions of calcium carbonate mostly less than 5 mm across; about 34 percent calcium carbonate equivalent; very strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—33 to 45 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; common concretions of calcium carbonate mostly less than 5 mm across; few soft masses of calcium carbonate; about 15 percent calcium carbonate equivalent; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Cdk—45 to 56 inches; red (2.5YR 4/6) slightly weathered clay, dark red (2.5YR 3/6) moist; massive; very hard, very firm; common strata and mottles of light olive gray (5Y 6/2); few fine and medium concretions of calcium carbonate; few crystals of gypsum; few rounded fragments of dolomite; about 8 percent paragravel of shale; strongly effervescent; moderately alkaline; clear smooth boundary.

2Cd—56 to 80 inches; stratified 1- to 3-inch-thick layers of reddish brown (2.5YR 4/4) fractured shale and red (2.5YR 5/6) silty clay loam; massive; very hard, very firm;

few flakes and lenses of light olive gray (5Y 6/2) loamy material; few crystals of gypsum; few thin fragments of dolomite; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches and corresponds to depth to densic bedrock. Weighted average clay content of the particle-size control section is dominantly between 25 and 33 percent but ranges from 18 to 33 percent. Depth to a distinct zone of calcium carbonate accumulation ranges from 8 to 32 inches. Fragments mainly less than 1/2 inch across range from 0 to 5 percent throughout the solum.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

The Bw horizon has colors similar to those of the A horizon. It is silty clay loam, clay loam, silt loam, or loam. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

The Bk horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Texture is silty clay loam, clay loam, silt loam, or loam. Content of visible calcium carbonate ranges from 8 to 40 percent. Calcium carbonate equivalent ranges from 15 to 40 percent. The horizon is strongly effervescent or violently effervescent. Reaction is moderately alkaline.

The 2Cdk horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Most horizons contain mottles in shades of brown and gray. Texture is clay, silty clay loam, silty clay, or clay loam. Interbedded layers and strata of partially weathered shale, sandstone, siltstone, or dolomitic limestone are common to some layers. Masses and concretions of calcium carbonate range from few to common. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

The 2Cd horizon consists of silty clay loam, clay, mudstone, and claystone. This densic material has rock-like structure and high bulk density that restricts plant roots to rock fractures. Thin strata of weakly cemented sandstone, siltstone, or dolomitic limestone are present in some layers. Masses of calcium carbonate and crystals of gypsum range from none to common. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

Beckman Series

The Beckman series consists of very deep, moderately well drained, nearly level soils on flood plains. These soils formed in deposits of calcareous and saline clayey alluvium eroded from nearby uplands. Permeability is very slow. Slopes are 0 to 1 percent. The soils of the Beckman series are fine, mixed, active, thermic Fluventic Haplustepts.

Beckman soils are commonly on the landscape with Knoco, Tilvern, and Vernon soils. These upland soils weathered from clayey Permian age deposits.

Typical pedon of Beckman clay, 0 to 1 percent slopes, frequently flooded; from the courthouse in Guthrie, 15.0 miles east on U.S. Highway 82, 7.1 miles southeast on State Highway 222, 5.0 miles south and 0.8 mile west on county road, 1.65 miles southeast and south on ranch road, 0.45 mile west, and 85 feet north of road in flood plain:

A—0 to 8 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; moderate medium angular blocky structure; extremely hard, very firm; common fine and medium roots; cracks 1.5 cm wide; nonsaline; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkyz1—8 to 23 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; moderate medium and coarse angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; cracks 1 to 1.5 cm wide; about 3 percent concretions of calcium carbonate; common fine and medium spots of gypsum and other salts on ped faces; slightly saline; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bkyz2—23 to 58 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium angular blocky; extremely hard, very firm; few fine roots and root channels mainly along vertical crack faces; few fine and very fine pores; few thin strata of weathered clay loam; about 3 percent concretions of calcium carbonate; few fine black concretions; many pockets of gypsum and other salts; common fragments of weathered dolomite as much as 1 cm across; 2 percent prominent gray (10YR 6/1) iron depletions lining pores; moderately saline; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cyz—58 to 77 inches; reddish brown (2.5YR 4/4) clay, dark red (2.5YR 3/6) moist; massive; extremely hard, very firm; few thin strata of loamy materials; many fragments of light gray and reddish brown shale with clay texture; common fragments of weathered dolomite as much as 1 cm across; few small pockets and crystals of gypsum and other salts; about 4 percent fine and medium prominent gray (10YR 6/1) iron depletions along fractures; slightly saline; strongly effervescent; moderately alkaline.

The horizons range from strongly effervescent to very strongly effervescent. Reaction is moderately alkaline. The clay content of the particle-size control section ranges from 35 to 60 percent. Fragments of dolomite less than 2 cm across range from 0 to 3 percent. Surface cracks more than 1 cm wide extend into the Bkyz horizon. The lower part of the subsoil in some pedons is saturated for extended periods.

The A horizon has hue of 5YR, value of 4 or 5, and chroma of 3 or 4. Where moist values and chromas are less than 3.5, the thickness is less than 10 inches. Electrical conductivity of the extract ranges from 0 to 8 dS/m.

The Bkyz horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay, silty clay, or silty clay loam. It contains few to common concretions of calcium carbonate and 1 to 15 percent gypsum and other salts. Weathered strata of loamy textures are in some pedons. Electrical conductivity of the extract ranges from 4 to 16 dS/m.

The C horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Texture is clay, silty clay, or silty clay loam and the horizon has few to many thin strata of various textures. There are few concretions of calcium carbonate, few fragments of shale, and few fragments of dolomitic limestone as much as 1 cm across. Also, there are few to many gypsum and other salt crystals. Electrical conductivity of the extract ranges from 4 to 16 dS/m.

Carey Series

The Carey series consists of very deep, well drained soils that formed in weakly consolidated silty or sandy Permian age deposits. Permeability is moderate. Slopes are 0 to 1 percent. The soils of the Carey series are fine-silty, mixed, superactive, thermic Typic Argiustolls.

Carey soils are commonly on the landscape with Paducah, St. Paul, and Woodward soils. Paducah and Woodward soils have an ochric epipedon, and Woodward soils have less than 18 percent clay in the particle-size control section. St. Paul soils have a mollic epipedon thicker than 20 inches.

Typical pedon of Carey loam in an area of Carey loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 2.05 miles west on Farm Road 193, 360 feet north on county road, and 240 feet east:

Ap—0 to 6 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine and medium subangular blocky and granular structure; hard, friable; many fine and medium roots; few fine pores; common worm channels and casts; neutral; abrupt smooth boundary.

A—6 to 16 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure; hard, friable; common fine and medium roots; few fine pores; common worm channels and casts; neutral; gradual smooth boundary.

Bt1—16 to 28 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; few worm channels and casts; common distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—28 to 37 inches; reddish yellow (5YR 6/6) loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; few fine pores; few worm channels and casts; common distinct reddish brown clay films on faces of peds; few fine black concretions; few fine concretions and soft masses of calcium carbonate; noneffervescent; moderately alkaline, gradual smooth boundary.

Bk1—37 to 53 inches; reddish yellow (5YR 6/6) loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine and medium roots; common fine and medium pores; few worm channels and casts; few faint clay films on faces of peds; about 15 percent concretions as much as 1.5 cm across and soft masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—53 to 66 inches; reddish yellow (5YR 7/6) loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; few fine roots; few fine pores; few worm channels filled with dark material; about 5 percent soft masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cd—66 to 80 inches; light red (2.5YR 6/6) very fine sandy loam, red (2.5YR 5/6) moist; massive, stratified; slightly hard, very friable; common thin strata of very pale brown (10YR 7/4) noncemented sandstone; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 70 inches. Reaction is neutral or slightly alkaline in the A horizon and ranges from neutral to moderately alkaline in the Bt horizon. The depth to secondary carbonates ranges from 20 to 30 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4, and chroma of 3.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, silty clay loam, or clay loam and ranges from 20 to 35 percent clay. In some pedons, the lower part of this horizon contains masses or concretions of calcium carbonate.

The Bk horizon has hue of 2.5YR to 7.5YR, value of 5 to 7, and chroma of 4 to 6. It is loam, silt loam, or very fine sandy loam and contains about 5 to 20 percent masses and concretions of calcium carbonate.

The Cd horizon has hue of 5YR or 2.5YR, value of 5 or 6, and chroma of 6. It is soft, noncemented sandstone. Reaction is moderately alkaline.

Cottonwood Series

The Cottonwood series consists of very shallow and shallow, well drained, gently sloping to steep soils on convex uplands. These soils formed in material weathered from impure gypsum of Permian age. Permeability is moderate. Slopes range from 3 to 45 percent. The soils of the Cottonwood series are loamy, mixed, superactive, calcareous, thermic, Lithic Ustorthents.

Cottonwood soils are commonly on the landscape with Aspermont, Knoco, Quanah, Talpa, Tilvern, and Vernon soils. Aspermont and Quanah soils generally occur in valley fills or draws and have sola thicker than 40 inches. Knoco, Tilvern, and Vernon soils have more than 35 percent clay in the particle-size control section and are underlain by shales and clays. Talpa soils are underlain by hard limestone.

Typical pedon of Cottonwood loam in an area of Cottonwood-Knoco complex, 3 to 20 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 3.2 miles east on Farm Road 1168, 3.0 miles east on Farm Road 3416, 9.7 miles southeast and east on county road, 1.1 miles north on ranch road, and 200 feet east of road in rangeland:

A1—0 to 5 inches; light brown (7.5YR 6/3) loam, brown (7.5YR 4/3) moist; moderate medium granular structure; soft, very friable; common fine and medium roots; common fine pores; strongly effervescent; moderately alkaline clear smooth boundary.

A2—5 to 12 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; soft, very friable; common fine and medium roots; common fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr1—12 to 20 inches; light gray (5Y 7/2) slightly weathered gypsum, olive gray (5Y 5/2) moist; massive; few roots in fractures; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cr2—20 to 22 inches; very pale brown (10YR 8/2) gypsum bedrock; massive; no roots; few fractures; neutral.

The thickness of the solum ranges from 3 to 14 inches. Clay content of the solum ranges from 18 to 27 percent. The calcium carbonate equivalent ranges from 5 to 30 percent. The horizons range from slightly effervescent to violently effervescent. Reaction is moderately alkaline.

The A horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 2 to 4. Where moist values are less than 3.5, thickness is less than 4 inches.

The Cr1 horizon has hue of 7.5YR to 5Y, value of 6 to 8, and chroma of 1 to 6. It is slightly weathered gypsum.

The Cr2 horizon has hue of 10YR to 5Y, value of 7 or 8, and chroma of 1 or 2. This horizon consists of massive crystalline gypsum or alabaster bedrock 5 to 15 feet thick that is weakly to strongly cemented and has hardness ranging from 1 to 2.5 on Mohs scale. The gypsum is interbedded with reddish brown and greenish gray shales that have clay texture and thin layers of dolomite. Some areas of the gypsum contain a few pink strata. This material is root restrictive and has moderate to high difficulty of excavation.

Delwin Series

The Delwin series consists of very deep, well drained, gently sloping soils on high terraces. These soils formed in sandy and loamy sediments. Permeability is moderate. Slopes range from 1 to 5 percent, but generally are less than 3 percent. The soils of the Delwin series are fine-loamy, mixed, active, thermic Typic Paleustalfs.

Delwin soils are commonly on the landscape with Devol, Grandfield, and Nobscot soils. Devol soils are on adjacent more sloping ridges and have less than 18 percent clay in the particle-size control section. Grandfield soils are on younger lower adjacent slopes and have a decrease in clay content in the lower part of the subsoil. Nobscot soils are on higher elevations and have surface layers thicker than 20 inches.

Typical pedon of Delwin sand in an area of Delwin sand, 1 to 5 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 1.5 miles east on Farm Road 3416, 1.0 mile north on Farm Road 1168, 0.95 mile east on county road, 3,100 feet north on field road and 100 feet west in cropland:

Ap1—0 to 9 inches; light reddish brown (5YR 6/4) sand, reddish brown (5YR 5/4) moist; single grain; loose; many fine and medium roots; few rounded siliceous gravel as much as 5 cm across; neutral; abrupt smooth boundary.

Ap2—9 to 17 inches; light reddish brown (5YR 6/4) sand, reddish brown (5YR 4/4) moist; single grain; loose; common roots; common soil fragments from lower horizon mixed by plowing; few rounded siliceous gravel as much as 5 cm across; neutral; abrupt smooth boundary.

Bt1—17 to 31 inches; reddish brown (2.5YR 5/4) sandy clay loam, reddish brown (2.5YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; many clay films on prism faces 1 chroma darker than soil matrix; few rounded siliceous gravel as much as 2 cm across; neutral; gradual smooth boundary.

Bt2—31 to 68 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; common clay films on faces of prisms 1 chroma darker than soil matrix; few rounded siliceous gravel as much as 2 cm across; neutral; gradual smooth boundary.

Bt3—68 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots; few clay films on prism faces 1 chroma darker than soil matrix; few rounded siliceous gravel as much as 2 cm across; slightly alkaline.

The thickness of the solum is more than 80 inches. Depth to secondary carbonates, where present, ranges from 60 to more than 80 inches. Thickness of the A horizons combined ranges from 5 to 20 inches.

The A horizon has hue of 5YR to 10YR, value of 4 to 7, and chroma of 2 to 4. Reaction is slightly acid or neutral.

The Bt1 horizon has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 3 to 8. Texture is sandy clay loam. Reaction is neutral or slightly alkaline.

The Bt2 and Bt3 horizons have hue of 2.5YR to 7.5YR, value of 5 to 7, and chroma of 6 to 8. Texture is sandy clay loam or fine sandy loam in the Bt2 horizon and is sandy clay loam in the Bt3. Reaction is neutral or slightly alkaline. Some pedons are moderately alkaline and noncalcareous below a depth of 60 inches.

Devol Series

The Devol series consists of very deep, well drained, gently sloping to moderately sloping soils on sandy uplands. These soils formed in sandy eolian sediment or in alluvial sediment reworked by wind. Permeability is moderately rapid. Slopes range from 3 to 8 percent. The soils of the Devol series are coarse-loamy, mixed, superactive, thermic Typic Haplustalfs.

Devol soils are commonly on the landscape with Delwin, Grandfield, Hardeman, Nobscot, and Shrewder soils. Delwin and Grandfield soils have more than 18 percent clay in the argillic horizon. Hardeman and Shrewder soils do not have an argillic horizon. Nobscot soils have a surface layer of sand that is more than 20 inches thick.

Typical pedon of Devol loamy sand in an area of Devol loamy sand, 3 to 8 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 3.13 miles east on Farm Road 1168 to its intersection with Farm Road 3416, 60 yards east, and 90 yards south of intersection in rangeland:

A1—0 to 4 inches; brown (7.5YR 4/3) loamy sand, dark brown (7.5YR 3/3) moist; single grained; soft, very friable; many fine and medium roots; neutral; clear smooth boundary.

A2—4 to 17 inches; brown (7.5YR 5/3) loamy sand, brown (7.5YR 4/3) moist; single grained and weak fine subangular blocky structure; soft, very friable; common fine and medium roots; neutral; clear smooth boundary.

Bt1—17 to 31 inches; yellowish red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure; slightly hard, friable; few fine roots; common fine and medium pores; clay bridges between sand grains; few faint clay films on prism faces; neutral; gradual smooth boundary.

Bt2—31 to 43 inches; brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure; slightly hard, friable; few fine roots; common fine and medium pores; common faint clay films on prism faces; neutral; gradual smooth boundary.

BC—43 to 56 inches; reddish yellow (7.5YR 7/6) loamy sand, reddish yellow (7.5YR 6/6) moist; single grain; loose; few light brown (7.5YR 6/4) lamellae in upper part decreasing with depth; few fine roots; slightly alkaline; gradual boundary.

C—56 to 80 inches; reddish yellow (7.5YR 8/6) loamy sand, reddish yellow (7.5YR 6/6) moist; single grain; loose; slightly alkaline.

The thickness of the solum ranges from 30 to 60 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Reaction ranges from slightly acid to slightly alkaline.

The Bt horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is sandy loam or fine sandy loam and averages between 8 and 18 percent clay content. Reaction ranges from neutral to slightly alkaline.

The BC horizon has hue of 2.5YR to 7.5YR, value of 5 to 7, and chroma of 4 to 6. It is loamy sand, loamy fine sand, or fine sand. Reaction ranges from neutral to moderately alkaline.

The C horizon has hue of 2.5YR to 7.5YR, value of 5 to 8, and chroma of 4 to 8. It is loamy sand, fine sand, or loamy fine sand. The horizon ranges from noneffervescent to strongly effervescent. Reaction ranges from neutral to moderately alkaline.

Enterprise Series

The Enterprise series consists of very deep, well drained, gently sloping soils on upland terraces. These soils formed in calcareous loamy eolian material. Permeability is moderately rapid. Slopes range from 1 to 5 percent. The soils of the Enterprise series are coarse-silty, mixed, superactive, thermic Typic Haplustepts.

Enterprise soils are commonly on the landscape with Grandfield, Jester, Westola, Woodward, and Yomont soils. Grandfield soils are on higher terraces and have an argillic horizon that has more than 18 percent clay in the particle-size control section. Jester soils are on lower elevations near flood plains and have horizons of loamy sand or coarser. Westola and Yomont soils are on flood plains and have stratified layers. Woodward soils formed in residuum of soft sandstone and are underlain by sandstone at a depth of 20 to 40 inches.

Typical pedon of Enterprise very fine sandy loam in an area of Enterprise very fine sandy loam, 1 to 3 percent slopes; from the courthouse in Guthrie, 0.5 mile south on U.S. Highways 82 and 83, 0.55 mile west on county road, and 60 feet north of county road in rangeland:

A1—0 to 7 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable; many fine and medium roots; slightly alkaline; clear smooth boundary.

Bk1—7 to 23 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few fine and medium roots; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bk2—23 to 48 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few fine and medium roots; common fine pores; common films and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—48 to 70 inches; red (2.5YR 5/6) very fine sandy loam, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; few fine pores; common films and threads of calcium carbonate; few gravel as much as 2 cm across; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—70 to 84 inches; yellowish red (5YR 5/6) loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; few fine roots; common thin sandy strata containing a few gravel as much as 3 cm across; slightly effervescent; moderately alkaline.

The thickness of the solum is more than 60 inches. Depth to carbonates ranges from 0 to 24 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The horizon ranges from noneffervescent to slightly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bk and BC horizons have hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 3 to 8. Texture is very fine sandy loam, loam, or silt loam. The horizons range from slightly effervescent to moderately effervescent. Reaction is slightly alkaline or moderately alkaline.

The C horizon has hue of 2.5YR or 5YR, value of 5 or 6, and chroma of 6 or 8. Texture is very fine sandy loam, silt loam, or loam with thin strata of coarser or finer textures. Gravel is present in some of the coarser strata. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

Foursixes Series

The Foursixes series consists of moderately deep, well drained, nearly level soils on ridgetops. These soils formed in clayey materials over indurated dolomitic limestone. Permeability is moderately slow. Slopes are 0 to 1 percent. The soils of the Foursixes series are fine, mixed, superactive, thermic Typic Haplustalfs.

Foursixes soils are commonly on the landscape with Cottonwood, Knoco, Talpa, Tilvern, Vernon, and Westill soils. Cottonwood soils are underlain by gypsum within a depth of 14 inches. Knoco soils are underlain by shale. Talpa soils are underlain by dolomitic limestone within a depth of 20 inches. Tilvern and Vernon soils do not have an argillic horizon and are underlain by claystone. Westill soils have sola thicker than 40 inches.

Typical pedon of Foursixes clay loam in an area of Foursixes clay loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 15.9 miles east on U.S. Highway 82, 4.1 miles north on ranch entrance road passing old ranch house and onto pipeline road, and 20 feet west of road in rangeland:

A—0 to 4 inches; brown (7.5YR 5/3) clay loam, dark brown (7.5YR 3/2) moist; weak fine granular and subangular blocky structure; very hard, firm; many fine and medium roots; neutral; clear smooth boundary.

Bt1—4 to 17 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; many prominent clay films 1 chroma darker than soil matrix; slightly alkaline; clear smooth boundary.

Btk—17 to 23 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; few fine roots; common distinct clay films 1 chroma darker than soil matrix; common very fine and fine concretions of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

R—23 to 48 inches; indurated, light gray dolomitic limestone bedrock; coarsely fractured; coatings of calcium carbonate less than 0.3 inch thick on surface of weathered bedrock and in fractures; few fractures penetrated by plant roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Cd1—48 to 66 inches; olive gray (5Y 5/2) shale with clay texture, olive gray (5Y 4/2) moist; massive; rock structure with many fractures; few streaks of weak red (10R 4/3) shale; few masses of calcium carbonate; moderately alkaline; strongly effervescent; gradual smooth boundary.

Cd2—66 to 80 inches; weak red (10R 4/3) shale with clay texture, dusky red (10R 3/3) moist; massive; rock structure with many fractures; few masses of calcium carbonate; moderately alkaline; strongly effervescent.

The thickness of the solum which corresponds to an abrupt contact with hard bedrock ranges from 20 to 40 inches. Weighted average clay content of the particle-size control section ranges from 35 to 50 percent. Depth to secondary carbonates, if present, ranges from 12 to 20 inches. A thin coating of precipitated calcium-magnesium carbonate is on the bedrock.

The A horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4. Texture is clay loam. Reaction is neutral or slightly alkaline. Thickness is 3 to 6 inches.

The Bt1 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Texture is clay loam or clay. Clay films are 1 chroma darker than the soil matrix. The horizon is noneffervescent or slightly effervescent. Reaction ranges from neutral to moderately alkaline.

The Btk horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Texture is clay or clay loam. Clay films are 1 chroma darker than soil matrix. The horizon ranges from noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline. Concretions and soft masses of calcium carbonate make up as much as 5 percent by volume in most pedons. Fragments of weathered dolomitic limestone, mainly less than 3 inches across, make up as much as 5 percent of the volume of some horizons.

The R layer is indurated and fractured dolomitic limestone about 1 to 3 feet thick. The surface of the limestone is weathered and fractured. The limestone commonly is capped with a thin coating of calcium-magnesium carbonate that seals some of the fractures.

The Cd1 and Cd2 horizons are stratified noncemented mudstone. The first densic horizon below the dolomitic limestone has color in shades of gray. The second densic horizon has color in shades of red. The horizons are strongly effervescent. Reaction is moderately alkaline.

Frankirk Series

The Frankirk series consists of very deep, well drained, nearly level and very gently sloping soils on uplands. These soils formed in clayey and loamy sediments of high terraces. Permeability is moderately slow. Slopes range from 0 to 2 percent. The soils of the Frankirk series are fine, mixed, superactive, thermic Typic Argiustolls.

Frankirk soils are commonly on the landscape with Grandfield, Tilvern, and Westill soils. Grandfield soils are on slightly higher slopes, do not have a mollic epipedon, and have less than 35 percent clay in the particle-size control section. Tilvern and Westill soils are on lower slopes and have carbonates near the surface. They are underlain by weakly consolidated Permian age shales at depths of less than 60 inches.

Typical pedon of Frankirk loam in an area of Frankirk loam, 0 to 2 percent slopes; from the courthouse in Guthrie, 8.0 miles east on U.S. Highway 82, 0.65 mile south on ranch entrance road, and 50 feet west of road in rangeland:

A—0 to 7 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure; hard, firm; many fine and medium roots; few worm channels and casts; neutral; clear smooth boundary.

Bt1—7 to 18 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak coarse prismatic structure parting to moderate medium angular blocky; very hard, firm; common fine roots; few fine pores; few worm channels and casts; common clay films on prism faces 1 chroma darker than soil matrix; neutral; gradual smooth boundary.

Bt2—18 to 37 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; common fine roots; few worm channels and casts; common prominent clay films on prism faces 1 chroma darker than soil matrix; few rounded siliceous gravel as much as 1 cm across; neutral; gradual smooth boundary.

Bt3—37 to 56 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few worm channels and casts; few faint clay films; common concretions of calcium carbonate; noneffervescent; moderately alkaline; gradual smooth boundary.

Bk1—56 to 73 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots; common fine pores; few faint clay films on prism faces; few fine concretions of calcium carbonate; slightly effervescent; neutral; gradual smooth boundary.

Bk2—73 to 84 inches; red 2.55YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; few fine roots; about 15 percent by volume concretions and masses of calcium carbonate; strongly effervescent; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. Depth to secondary carbonates range from 29 to 48 inches.

The A horizon has hue of 7.5YR, value of 4, and chroma of 2 or 3. Reaction is neutral or slightly alkaline.

The Bt1 horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3. It is clay loam or clay. Reaction is neutral or slightly alkaline.

The Bt2 and Bt3 horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. They are clay, clay loam, or sandy clay with clay content of 35 to 45 percent. Reaction ranges from neutral to moderately alkaline.

The Bk horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma that is dominantly 6. They are sandy clay loam or clay loam with 20 to 30 percent clay. Calcium carbonate masses and concretions range from 2 percent in the upper part to 15 percent in the lower part. The horizon ranges from slightly effervescent to strongly effervescent.

Grandfield Series

The Grandfield series consists of very deep, well drained, nearly level to gently sloping soils on uplands. These soils formed in old alluvium that has been reworked by wind. Permeability is moderate. Slopes range from 0 to 5 percent. The soils of the Grandfield series are fine-loamy, mixed, superactive, thermic Typic Haplustalfs.

Grandfield soils are commonly on the landscape with the Delwin, Devol, Frankirk, Miles, and Nobscot soils. Delwin and Miles soils do not decrease as much as 20 percent clay within a depth of 60 inches. Devol soils have less than 18 percent clay in the particle-size control section. Frankirk soils have mollic surfaces and more than 35 percent clay in the particle-size control section. Nobscot soils have sandy surface layers thicker than 20 inches.

Typical pedon of Grandfield fine sandy loam in an area of Grandfield fine sandy loam, 1 to 3 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S.

Highway 83; 3.15 miles west on Farm Road 193, 2.0 miles north on county road, and 4,900 feet west of road in rangeland:

A—0 to 8 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; slightly hard, friable; many roots; common worm channels and casts; few siliceous gravel as much as 2 cm across; neutral; clear smooth boundary.

Bt1—8 to 20 inches; reddish brown (5YR 4/4) sandy clay loam, reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; common fine roots; common fine pores; few worm channels and casts; common clay films on prism faces 1 chroma darker than soil matrix; slightly alkaline; gradual smooth boundary.

Bt2—20 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; few roots; few fine pores; few worm channels and casts; common clay films on prism faces 1 to 2 chroma darker than soil matrix; slightly alkaline; gradual smooth boundary.

Bt3—38 to 50 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; slightly hard, very friable; few fine roots; common fine, medium, and coarse pores; few faint clay films on prism faces 1 chroma darker than soil matrix; few films and soft masses of calcium carbonate in lower part; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk—50 to 60 inches; red (2.5YR 4/8) fine sandy loam, red (2.5YR 4/8) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; few very fine pores; few dark stains on faces of prisms; common films and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—60 to 80 inches; red (2.5YR 5/8) fine sandy loam, red (2.5YR 4/8) moist; weak coarse prismatic structure; soft, very friable; few films and threads of calcium carbonate; few siliceous pebbles; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 inches to more than 80 inches. Thickness of the surface layer ranges from 5 to 20 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam, or loamy sand. Reaction ranges from slightly acid to slightly alkaline.

The Bt1 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy clay loam or fine sandy loam, and clay content ranges from 18 to 30 percent. Reaction ranges from slightly acid to slightly alkaline.

The Bt2, Bt3, Bk, and BCk horizons have hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is fine sandy loam or sandy clay loam. The horizons range from noneffervescent to strongly effervescent. Reaction ranges from neutral to moderately alkaline. Most pedons are calcareous in the Bk and BCk horizons.

The C horizon, where present, has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8. Texture is fine sandy loam or loamy sand and some pedons are stratified with coarser or finer material. The horizon ranges from noneffervescent to strongly effervescent. Reaction ranges from neutral to moderately alkaline.

Hardeman Series

The Hardeman series consists of very deep, well drained, gently sloping soils on uplands (fig. 22). These soils formed in calcareous loamy eolian and alluvial sediments. Permeability is moderately rapid. Slopes range from 1 to 5 percent. The soils of the Hardeman series are coarse-loamy, mixed, superactive, thermic Typic Haplustepts.

Hardeman soils are commonly on the landscape near Devol, Jester, Shrewder, and Woodward soils, Devol soils are on higher terraces and have an argillic horizon. Jester soils are near flood plains and have loamy sand or sand particle-size control sections. Shrewder soils are on high terraces and have carbonates below 28 inches. Woodward soils are underlain by soft sandstone at a depth of 20 to 40 inches.

Typical pedon of Hardeman fine sandy loam in an area of Hardeman fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 193 and Farm Road 2569 in Dumont, 0.7 mile north on Farm Road 2569, and 2,100 feet east in cultivated field:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; few fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A—7 to 12 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

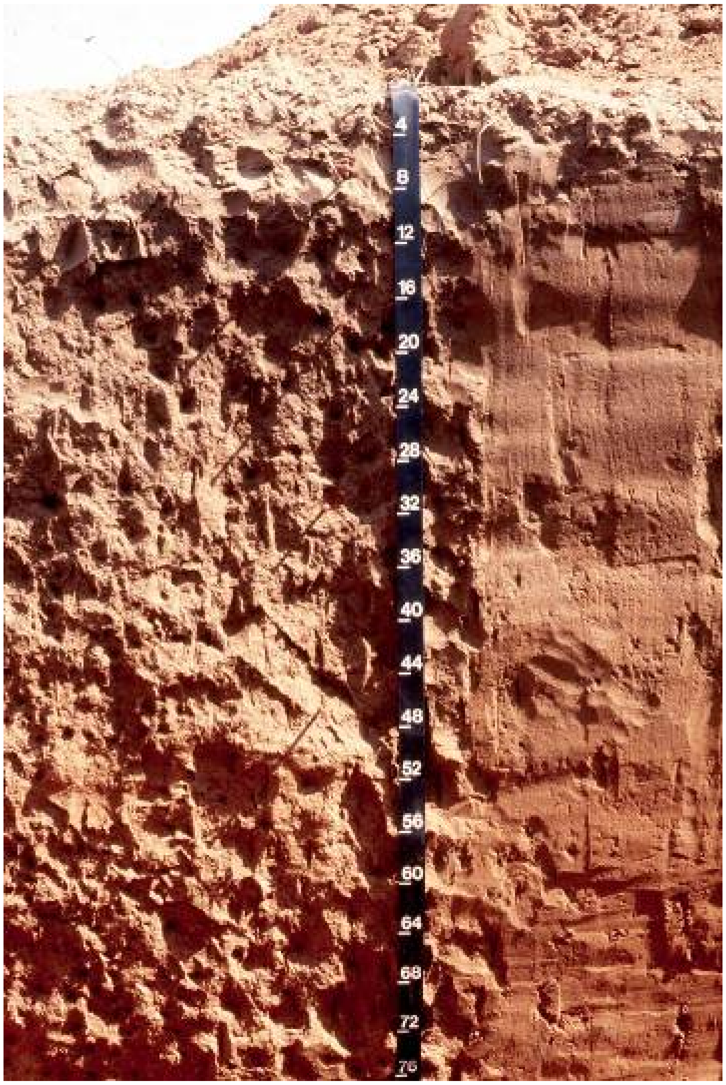

Figure 22.—Profile of Hardeman fine sandy loam in an area of Hardeman fine sandy loam, 1 to 5 percent slopes.

Bw—12 to 33 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few fine threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—33 to 80 inches; light reddish brown (5YR 6/4) fine sandy loam, yellowish red (5YR 5/6) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard; friable; few fine roots; many masses and threads of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to 80 or more inches. The depth to secondary carbonates ranges from 0 to 28 inches. The particle-size control section ranges from 12 to 18 percent clay and more than 15 percent of the sands are coarser than very fine sand. Siliceous gravel, mainly less than 1.5 inches across, ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. The horizon ranges from noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bw and Bk horizons have hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 6. Texture is fine sandy loam or loam. Reaction is moderately alkaline. Calcium carbonate ranges from few films and threads in the Bw horizon to many masses and threads in the Bk horizon.

Jaywi Series

The Jaywi series consists of very deep, well drained soils on uplands. These soils formed in calcareous loamy colluvium and terrace alluvium. Permeability is moderate. Slopes range from 2 to 5 percent. The soils of the Jaywi series are fine-silty, mixed, active, thermic Typic Haplustepts.

Jaywi soils are commonly on the landscape with Cottonwood, Knoco, Quanah, Talpa, Vernon, and Wheatwood soils. Cottonwood, Knoco, and Talpa soils are on upper slopes and are less than 20 inches in depth. Quanah soils are on lower slopes and have a mollic epipedon. Vernon soils are on upper slopes and have more than 35 percent clay in the particle-size control section. Wheatwood soils are on flood plains and contain stratified lower layers.

Typical pedon of Jaywi silty clay loam in an area of Jaywi silty clay loam, 2 to 5 percent slopes; from the courthouse in Guthrie; 13.5 miles north on U.S. Highway 83, 3.2 miles east on Farm Road 1168, 3.0 miles east on Farm Road 3416 to county road, 2.75 miles southeast on county road, 1.65 miles south on county road, 0.6 mile southwest on oil field road, 0.45 mile south, 0.5 mile west, 1.1 miles south to road culvert in the channel of the Middle Fork of the Wichita River, and 160 yards west of culvert in rangeland:

A—0 to 5 inches; brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) moist; moderate fine and medium subangular blocky and granular structure; hard, firm; many fine and medium roots; few very fine pores; common worm channels and casts; few fragments of rounded dolomitic limestone as much as 1 cm across; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—5 to 21 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few very fine pores; few worm channels and casts; few fragments of rounded dolomitic limestone as much as 1 cm across; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—21 to 56 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, friable; few fine roots; few very fine pores; few worm channels and casts; few fine black concretions; few concretions and soft masses of calcium carbonate as much as 4 mm across; few fragments of rounded dolomitic limestone as much as 1 cm across; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Bk2—56 to 80 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few very fine and fine pores; few concretions of calcium carbonate as much as 3 mm across; old worm channels filled with hardened calcium carbonate; few fine black concretions; few fragments of rounded dolomitic limestone as much as 1 cm across; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Weighted average clay content of the particle-size control section ranges from 18 to 35 percent. The horizons are strongly effervescent. Reaction is moderately alkaline. The calcium carbonate equivalent of the particle-size control section ranges from 2 to 20 percent. Fragments of dolomitic limestone, mainly less than 3 cm across, range from 0 to 10 percent throughout the soil.

The A horizon has hue of 5YR to 10YR, value of 4 or 6, and chroma of 3 or 4. Non-mollic A2 horizons are present in some pedons. Texture is silty clay loam.

The Bw horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 4. Texture is loam, clay loam, or silty clay loam.

The Bk1 and Bk2 horizons have hue of 5YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. Texture is loam, clay loam, silty clay loam, or silt loam. Volume of carbonate masses ranges from 10 to 25 percent. Crystals of gypsum range from 0 to 5 percent by volume.

Jester Series

The Jester series consists of very deep, excessively drained soils. These soils formed in hummocky sandy eolian sediment on flood plains or on uplands adjacent to flood plains. Permeability is rapid. Slopes range from 3 to 12 percent. The soils of the Jester series are mixed, thermic Typic Ustipsamments.

Jester soils are commonly on the landscape with Devol, Enterprise, Hardeman, Lincoln, Westola, and Yomont soils. Devol, Enterprise, and Hardeman soils have a weighted average texture finer than loamy fine sand in the particle-size control section. Lincoln, Westola, and Yomont soils formed in recent alluvial sediment. Westola and Yomont soils have a weighted average texture finer than loamy fine sand in the particle-size control section.

Typical pedon of Jester loamy sand in an area of Jester loamy sand, 3 to 12 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 3.15 miles west on Farm Road 193, 2.5 miles north on county road, and 450 feet east in rangeland:

A—0 to 11 inches; light brown (7.5YR 6/4) loamy sand, brown (7.5YR 4/4) moist; single grained; loose; common fine and medium roots; very slightly effervescent; moderately alkaline; clear smooth boundary.

C1—11 to 26 inches; light reddish brown (5YR 6/4) loamy sand, yellowish red (5YR 5/6) moist; single grained; loose; common fine roots; very slightly effervescent; moderately alkaline; gradual smooth boundary.

C2—26 to 80 inches; pink (5YR 7/4) loamy sand, yellowish red (5YR 5/6) moist; single grained; loose; few fine roots; very slightly effervescent; moderately alkaline.

The depth to bedrock is greater than 80 inches. The particle-size control section is loamy sand or coarser.

The A horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. The horizon is very slightly effervescent. Reaction is slightly alkaline or moderately alkaline.

The C horizon has hue of 5YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6. The horizon is very slightly effervescent. Reaction is moderately alkaline.

Kingco Series

The Kingco series consists of very deep, moderately well drained, nearly level soils on uplands. These soils formed in clayey sediments of Permian age and old alluvium. Permeability is slow. Slopes are 0 to 1 percent. The soils of the Kingco series are fine, mixed, active, thermic Typic Haplusterts.

Kingco soils are commonly on the lower part of the landscape near the Aspermont, Tilvern, and Westill soils. Aspermont soils have ochric epipedons and a fine-silty particle-size control section. Tilvern soils have ochric epipedons. Westill soils have argillic horizons.

Typical pedon of Kingco silty clay loam in an area of Kingco silty clay loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 1.1 miles south and east on U.S. Highway 82, 0.5 mile south on private ranch road, and 80 feet east in rangeland:

A—0 to 12 inches; dark brown (7.5YR 3/2) silty clay loam, very dark brown (7.5YR 2/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common fine and medium roots; few fine pores; common worm channels and casts; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bss1—12 to 35 inches; dark reddish gray (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) moist; moderate medium angular blocky structure; very hard, very firm; common fine and medium roots; few fine pores; common worm channels and casts; about 3 percent concretions of calcium carbonate; common intersecting slickensides; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Bss2—35 to 51 inches; reddish brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) moist; moderate medium and coarse angular blocky structure; very hard, very firm; few very fine and fine roots; few fine pores; common intersecting slickensides; about 4 percent by volume of concretions of calcium carbonate as much as 5 mm across; strongly effervescent; moderately alkaline; gradual wavy boundary.

BC—51 to 82 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, very firm; few very fine and fine roots; few fine pores; few fine concretions of calcium carbonate; ped faces are slightly effervescent; soil matrix mostly noneffervescent; moderately alkaline.

The thickness of the solum ranges from 65 to more than 80 inches. The particle-size control section has 40 to 55 percent clay. This is a cyclic soil and undisturbed areas have gilgai microrelief with microknolls 3 to 8 inches higher than microdepressions. Distance between the center of the microknoll and the center of the microdepression is about 5 to 15 feet. The microknoll makes up about 25 percent; the intermediate, or the area between the knoll and depression, about 45 percent; and the microdepression about 30 percent. When dry, cracks 1/2 inch to 2 inches wide extend from the surface to a depth of 30 inches or more. Slickensides begin at a depth of 6 to 21 inches and extend to a depth of 45 to 60 inches which corresponds to the depth to the BC horizon.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or less. Horizons with a chroma of 1 average less than 7 inches thick. More than half of the surface layer consists of chroma of 2. Moist color value is 2 or 3. Thickness of the A horizon varies with microrelief and ranges from 6 to 12 inches. The horizon ranges from noneffervescent to slightly effervescent. Reaction is slightly alkaline. In some pedons an A2 horizon is present, and has the same color, texture, and reaction as the A1 horizon.

The Bss1 horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. Chroma of 3 occurs in the microknolls and makes up less than half of this layer. Moist color value is 2 or 3. Texture is clay or silty clay. The horizon is strongly effervescent. Reaction is moderately alkaline.

The Bss2 horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. Moist color value is 3 or 4. Texture is clay or silty clay. Very fine or fine concretions of calcium carbonate range from few to common. Masses of gypsum range from few to common in some pedons. The horizon is strongly effervescent. Reaction is moderately alkaline.

The BC horizon has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 3 to 6. Moist color value is 3 to 6. Texture is clay loam, silty clay loam, or clay. Some pedons have coatings of calcium carbonate between peds. Hard and soft powdery masses of calcium carbonate range from few to common. A few crystals of gypsum are generally present, and some pedons contain as much as 10 percent. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

The C horizon, where present, is reddish weathered shale and clays of the Blaine Formation (Permian System). Strata and mottles in shades of gray and green, and thin lenses of gypsum are common. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

Knoco Series

The Knoco series consists of very shallow and shallow, well drained, gently sloping to steep soils on uplands (fig. 23). These soils formed in noncemented claystone of Permian age. Permeability is very slow. Slopes range from 2 to 20 percent. The soils of the Knoco series are clayey, mixed, active, calcareous, thermic, shallow Aridic Ustorthents.

The Knoco soils are commonly adjacent on the landscape to Cottonwood, Talpa, and Vernon soils. Cottonwood and Talpa soils have less than 35 percent clay in the particle-size control section and are underlain by gypsum and limestone. Vernon soils have a solum 20 to 40 inches thick.

Typical pedon of Knoco clay in an area of Badland-Knoco complex, 2 to 20 percent slopes; from the courthouse in Guthrie, 11.7 miles south on U.S. Highway 83, 2.45 miles west on county road, 0.5 mile south, 0.83 mile west, 2.3 miles south, and 175 feet east in rangeland:

A1—0 to 6 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine and medium angular blocky structure; very hard, very firm; common fine and medium roots; few very fine pores; few fine and medium concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

A2—6 to 13 inches; reddish brown (2.5YR 4/4) clay, dark red (2.5YR 3/6) moist; moderate fine and medium angular blocky structure; very hard, very firm; few fine and medium roots; common fine concretions of calcium carbonate; common partially weathered fragments of noncemented claystone in lower part; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cd—13 to 80 inches; red (2.5YR 4/6) dense clay containing noncemented shale fragments, dark red (2.5YR 3/6) moist; common distinct relict mottles of light olive gray (5Y 6/2); massive; rock structure with many cleavage planes; few fine and medium roots concentrated between cleavage plates; common strata of red and light olive gray noncemented claystone; few masses of gypsum crystals; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 3 to 20 inches, which corresponds to the depth to dense clay containing shale fragments or noncemented claystone. Calcareous nodules are on the surface of some pedons. There are few to many rounded siliceous gravel on the surface. Limestone stones and boulders are on the surface of some pedons below areas of limestone outcrops. Fragments range from 1 to 6 feet across, and are about 3 to 24 inches thick. These fragments cover about 2 to 25 percent of the surface in some soil areas. The horizons are strongly effervescent. Reaction is moderately alkaline.

Figure 23.—Typical profile of Knoco clay in an area of Badland-Knoco complex, 2 to 20 percent slopes.

The A1 horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 or 6. Texture is clay or clay loam with clay content ranging from 35 to 55 percent.

The A2 horizon has colors in shades of red or reddish brown. Texture is clay. It contains few to common fragments of shale that crush or slake to clay texture. Some pedons contain a few gypsum crystals.

The Cd horizon has colors mainly in shades of red or gray. It is dense clay containing fragments and strata of dense and fractured noncemented claystone that weathers to silty clay or clay texture. Some pedons contain thin discontinuous strata of limestone or gypsum. Root penetration is restricted to cleavage planes or fractures. The material is massive or has coarse or very coarse angular rock-like fragments and slakes in water.

Lazare Series

The Lazare series consists of very deep, somewhat poorly drained, nearly level soils in upland depressions. These soils formed in clayey materials. Permeability is very slow.

Slopes are 0 to 1 percent. The soils of the Lazare series are fine, smectitic, thermic Udic Haplusterts.

Lazare soils are commonly on the landscape with Frankirk, Kingco, Quanah, Talpa, and Westill soils. Relative to these soils, the Lazare soils occupy the lowest place on the landscape. Frankirk and Westill soils have an argillic horizon. Kingco soils are dominated by 2 or higher chroma. Quanah soils have fine-silty particle-size control sections. Talpa soils are underlain by dolomite at shallow depths.

Typical pedon of Lazare clay in an area of Lazare clay, 0 to 1 percent slopes, occasionally ponded; from the courthouse in Guthrie, 7.4 miles south and east on U.S. Highway 82 and 100 feet north of highway in rangeland:

A—0 to 12 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; very hard, very firm; few fine and medium roots; slightly alkaline; noneffervescent; gradual wavy boundary.

Bss—12 to 39 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common intersecting slickensides; few very fine concretions of calcium carbonate; moderately alkaline; slightly effervescent; gradual wavy boundary.

Bkss—39 to 69 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common intersecting slickensides; about 5 percent by volume concretions, threads, and films of calcium carbonate; moderately alkaline; strongly effervescent; gradual wavy boundary.

Bk—69 to 90 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots; about 8 percent by volume concretions, threads, and films of calcium carbonate; moderately alkaline; strongly effervescent.

The thickness of the solum is more than 80 inches. The depth to the calcic horizon is 40 to more than 80 inches. The particle-size control section has 40 to 50 percent clay. These soils are ponded for about 2 to 7 days in most years. This is a cyclic soil, and undisturbed areas have gilgai microrelief with microknolls 6 to 20 inches higher than microdepressions. When dry, cracks 0.5 to 2 inches wide extend from the surface to a depth of 40 inches or more. Cracks are more prominent in the microdepressions. Cracks open and close each year and remain open for more than 150 cumulative days during most years. Slickensides begin at a depth of 8 to 16 inches.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. A chroma of 2 makes up less than one-half of the horizon. Moist color value is 2 to 4. Where moist color values are 4, they make up less than one-half of the matrix. The horizon is noneffervescent or slightly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bss horizon has hue of 10YR, value of 3 to 5, and a chroma of 1 or 2. Moist color value is 2 to 4. Where moist color values are 4, they make up less than one-half of the matrix. Very fine to fine concretions of calcium carbonate and iron-manganese range from none to common. The horizon is noneffervescent or slightly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bkss horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. Moist color value is 3 to 5. Concretions, masses, or filaments of calcium carbonate range from few to common. Calcium carbonate equivalent ranges from 3 to 25 percent by volume.

The Bk horizon has hue of 7.5YR or 10YR, value of 5 to 8, and chroma of 1 to 4. Texture is clay or clay loam. Concretions, masses, or filaments of calcium carbonate range from common to many. Calcium carbonate equivalent ranges from 5 to 25 percent by volume.

Lincoln Series

The Lincoln series consists of very deep, somewhat excessively drained, nearly level soils on flood plains.

These soils formed in sandy alluvium that contains thin loamy strata. They have a water table at a depth of 5 to 8 feet during winter and spring. Permeability is rapid. Slopes are 0 to 1 percent. The soils of the Lincoln series are sandy, mixed, thermic Typic Ustifluvents.

Lincoln soils are commonly on the landscape near Jester and Westola soils. Jester soils are on higher convex ridges and are not stratified with textures finer than loamy fine sand in the particle-size control section. Westola soils have textures finer than loamy fine sand in the particle-size control section.

Typical pedon of Lincoln loamy sand in an area of Lincoln soils, 0 to 1 percent slopes, frequently flooded; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 4.4 miles west on Farm Road 193, 2.1 miles northeast on ranch entrance road, and 100 feet east in flood plain of the North Wichita River:

A—0 to 6 inches; brown (7.5YR 5/4) loamy sand, brown (7.5YR 4/4) moist; weak medium granular structure; soft, very friable; common fine, medium, and coarse roots; about 7 percent by volume of siliceous gravel as much as 3 inches across; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—6 to 72 inches; light reddish brown (5YR 6/4) sand, reddish brown (5YR 5/4) moist; single grained; loose, very friable; few fine and medium roots; few thin loamy strata; about 7 percent by volume of siliceous gravel as much as 3 inches across; slightly effervescent; moderately alkaline; gradual smooth boundary.

C2—72 to 80 inches; light brown (7.5YR 6/4) sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; few fine roots; common strata as much as 2 inches thick of loamy fine sand; few thin loamy strata; about 7 percent by volume of siliceous gravel as much as 3 inches across; slightly effervescent; moderately alkaline.

The horizons range from very slightly effervescent to strongly effervescent. Reaction is moderately alkaline. The average texture of the particle-size control section is loamy sand or coarser. All horizons contain 0 to 10 percent by volume of coarse fragments from 2 mm to 3 inches across.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. Texture is loamy sand.

The C horizon has hue of 5YR or 7.5YR, value of 6 or 7, and chroma of 3 to 6. Texture is loamy sand, fine sand, or sand with strata of sandy or loamy materials. Thin strata of sandy or loamy materials occur throughout this horizon.

Miles Series

The Miles series consists of very deep, well drained, nearly level soils on uplands. These soils formed in old alluvium that has been reworked by wind. Permeability is moderate. Slopes are 0 to 1 percent. The soils of the Miles series are fine-loamy, mixed, superactive, thermic Typic Paleustalfs.

Miles soils are commonly on the landscape with the nearby Devol, Frankirk, and Grandfield soils. Devol soils have less than 18 percent clay in the particle-size control section. Frankirk soils have a mollic surface layer and more than 35 percent clay in the particle-size control section. Grandfield soils have a decrease in clay within a depth of 60 inches.

Typical pedon of Miles fine sandy loam in an area of Miles fine sandy loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 8.3 miles west on Farm Road 193, and 75 feet south of road in rangeland:

A—0 to 14 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/4) moist; moderate fine granular structure; slightly hard, friable; many fine, medium, and few coarse roots; few fine pores; common worm channels and casts; few siliceous gravel as much as 2 cm across; neutral; clear smooth boundary.

BA—14 to 19 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; few roots; common fine pores; few worm channels and casts; common clay films on prism faces 1 chroma darker than soil matrix; slightly alkaline; gradual smooth boundary.

Btk1—19 to 49 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few roots; few fine pores; few worm channels and casts; common clay films on prism faces 1 to 2 chroma darker than soil matrix; few soft masses of calcium carbonate in lower part; slightly alkaline; gradual smooth boundary.

Btk2—49 to 80 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; very hard, firm; common fine, medium, and coarse pores; common clay films on prism faces 1 chroma darker than soil matrix; few soft masses of calcium carbonate; moderately alkaline.

The thickness of the solum ranges from 60 inches to more than 80 inches. The thickness of the surface layer ranges from 5 to 20 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Organic matter content is less than 1 percent. Reaction ranges from slightly acid to slightly alkaline.

The BA horizon, where present, ranges from loam to sandy clay loam.

The Btk1 and Btk2 horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. Texture is sandy clay loam or loam, and clay content ranges from 20 to 35 percent. The horizons are noneffervescent or slightly effervescent. Reaction ranges from neutral to moderately alkaline.

The BCk horizon, where present, has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is fine sandy loam or sandy clay loam. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

Nipsum Series

The Nipsum series consists of very deep, well drained, nearly level and very gently sloping soils on valleys and stream terraces. These soils formed in material weathered from local stream outwash. Permeability is slow. Slopes range from 0 to 2 percent. The soils of the Nipsum series are fine, mixed, superactive, thermic Cumulic Haplustolls.

Nipsum soils are commonly on the landscape with Aspermont, Cottonwood, Quanah, Talpa, Wheatwood, and Yomont. Aspermont soils do not have a mollic epipedon and have less than 35 percent clay in the particle-size control section. Cottonwood and Talpa soils have sola less than 20 inches thick. Quanah soils have a mollic surface layer less than 20 inches thick and have a fine-silty particle-size control section. Wheatwood and Yomont soils are on flood plains. They have less than 35 percent clay in the particle-size control section and have ochric epipedons.

Typical pedon of Nipsum silty clay in an area of Nipsum silty clay, 0 to 2 percent slopes; from the courthouse in Guthrie, 15.9 miles east on U.S. Highway 82, 6.6 miles north on ranch entrance road passing old ranch house and onto pipeline road to channel of North Wichita River, continue north-northwest 0.7 mile on pipeline road, 0.75 mile west, 0.45 mile northwest, and 50 feet south in rangeland:

A1—0 to 13 inches; dark reddish gray (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) moist; moderate fine subangular blocky structure; very hard, friable; common fine and medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

A2—13 to 29 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; common very fine and fine concretions and medium masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—29 to 48 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; about 8 percent by volume of concretions and masses of calcium carbonate; common crystals and spots of gypsum; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—48 to 80 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; about 10 percent by volume of concretions and masses of calcium carbonate; common crystals and spots of gypsum; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The mollic epipedon ranges from 20 to 40 inches thick.

The A1 and A2 horizons have hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. The horizons range from noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Texture is clay or silty clay. Concretions and masses of calcium carbonate make up about 1 to 10 percent by volume. Crystals and spots of gypsum range from about 2 to 15 percent by volume. The horizon ranges from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

Nobscot Series

The Nobscot series consists of very deep, well drained, gently sloping soils on sandy uplands. These soils formed in very deep sandy outwash deposits modified by wind. Permeability is moderately rapid. Slopes range from 1 to 5 percent. The soils of the Nobscot series are loamy, mixed, superactive, thermic Arenic Paleustalfs.

Nobscot soils are commonly on the landscape with Devol, Delwin, and Grandfield soils. All of these soils occur on lower slopes and have a surface layer less than 20 inches thick.

Typical pedon of Nobscot sand in an area of Nobscot sand, 1 to 5 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 3.2 miles east on Farm Road 1168, 3.0 miles east on Farm Road 3416, 0.25 mile north on county road, and 200 feet west in rangeland:

A—0 to 8 inches; yellowish brown (10YR 5/4) sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

E—8 to 29 inches; pink (7.5YR 7/4) sand, light brown (7.5YR 6/4) moist; single grained; loose; common fine and medium roots; neutral; clear wavy boundary.

Bt1—29 to 43 inches; red (2.5YR 5/6) sandy loam, red (2.5YR 4/6) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; common discontinuous bands of reddish brown (2.5YR 4/4) sandy loam 1/4 to 3/4 inch thick; sand grains coated and bridged with clay; common prominent clay films on faces of prisms 1 chroma darker than soil matrix; few fine and medium roots; common medium and coarse pores; common voids and old root channels filled with clean sand grains; neutral; gradual smooth boundary.

Bt2—43 to 55 inches; light red (2.5YR 6/6) loamy sand, red (2.5YR 4/6) moist; weak coarse prismatic structure; slightly hard, very friable; common red (2.5YR 5/6) sandy loam lamellae 1/8 to 1 inch thick and 4 to 6 inches apart; sand grains coated and bridged with clay; few fine and medium roots; few fine pores; few clay films on faces of prisms; common pockets of clean sand grains; neutral; gradual smooth boundary.

Bt3—55 to 90 inches; reddish yellow (5YR 6/6) loamy sand, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; slightly hard, very friable; few yellowish red (5YR 5/6) sandy loam lamellae 1/4 to 3/4 inch thick and 6 to 8 inches apart; few fine roots; sand grains coated and bridged with clay; about 5 percent by volume of pockets of clean sand grains; neutral.

The thickness of the solum is more than 60 inches. Combined thickness of the A and E horizons is 20 to 40 inches. Reaction is neutral or slightly acid.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. In cultivated areas the Ap horizon is commonly mixed with the E horizon.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 8, and chroma of 2 to 4.

The Bt horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. It is dominantly sandy loam, loamy sand, or sand, but in the upper Bt horizon there is a layer of sandy loam that is at least 10 inches thick. The lower Bt horizons contain lamellae of sandy loam that are 1/8 inch to 6 inches thick and from 2 to 8 inches apart.

The BC horizon, where present, has hue of 2.5YR or 5YR, value of 5 or 6, and chroma of 6 to 8. Texture is loamy sand or loamy fine sand, and the horizon contains lamellae of sandy loam or loamy sand that are 3 to 8 inches apart and 1/8 inch to 1 inch thick.

Obaro Series

The Obaro series consists of moderately deep, well drained, gently sloping soils on uplands. These soils formed in noncemented sandstone, siltstone, and interbedded shale and clay of Permian age. Permeability is moderate. Slopes range from 1 to 4 percent. The soils of the Obaro series are fine-silty, mixed, active, thermic Typic Haplustepts.

Obaro soils are commonly on the landscape with Carey, Paducah, Quinlan, St. Paul, and Woodward soils. Carey, Paducah, and St. Paul soils are on lower elevations and have an argillic horizon. Carey and St. Paul soils have a mollic epipedon. Quinlan and Woodward soils are on higher elevations and have less than 18 percent clay in the particle-size control section. Quinlan soils have sandstone within a depth of 20 inches.

Typical pedon of Obaro loam in an area of Obaro loam, 1 to 4 percent slopes; from the courthouse in Guthrie, 11.7 miles south on U.S. Highway 83, 2.2 miles west on county road, 400 feet southeast on ranch road, and 50 feet northeast of road in rangeland:

A—0 to 7 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky and granular structure; slightly hard, friable; common fine and medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—7 to 23 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine and few medium roots; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk—23 to 38 inches; reddish yellow (5YR 6/6) loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; common concretions, films, and masses of calcium carbonate; common fragments of shale in lower part; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cd—38 to 43 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak medium platy and massive rock structure; very hard, firm; few fine roots; common strata of very fine sandy loam and mudstone granules; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The clay content ranges from 18 to 40 percent, but is mainly 18 to 30 percent, and contains less than 15 percent coarser than very fine sand. The horizons range from slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The Bw and Bk horizons have a hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Texture is loam, silt loam, or silty clay loam. Soft masses, concretions, and threads of calcium carbonate increase with depth to as much as 10 percent.

The Cd horizon is thinly stratified with layers of fractured siltstone, noncemented sandstone, sandy material, silt loam, and silty clay loam. Mudstone fragments are in some pedons. This material is mainly nonparalithic. It has high bulk density and is root restrictive.

Paducah Series

The Paducah series consists of very deep, well drained, very gently sloping soils on uplands. These soils formed in noncemented sandstone of Permian age. Permeability is moderate. Slopes range from 1 to 3 percent. The soils of the Paducah series are fine-silty, mixed, superactive, thermic Typic Haplustalfs.

Paducah soils are commonly on the landscape with Carey, Obaro, Quinlan, Shrewder, St. Paul, and Woodward soils. Carey and St. Paul soils are on lower elevations and have mollic epipedons. Obaro, Quinlan, Shrewder, and Woodward soils are on higher elevations and do not have an argillic horizon.

Typical pedon of Paducah loam in an area of Paducah loam, 1 to 3 percent slopes; from the courthouse in Guthrie, 0.5 mile south on U.S. Highways 82 and 83, 7.5 miles west and southwest on county road to a ranch road which is near a 90-degree curve in county road, and 100 feet northeast of intersection in rangeland:

A—0 to 8 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak fine granular and subangular blocky structure; slightly hard, friable; common fine and medium roots; few worm channels and casts; neutral; clear smooth boundary.

Bt1—8 to 13 inches; reddish brown (2.5YR 4/4) loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine and few medium roots; common very fine and fine pores; common worm channels and casts; few faint clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Bt2—13 to 21 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm; few fine and medium roots; common very fine and fine pores; common worm channels and casts; common distinct clay films on faces of prisms; slightly alkaline; gradual smooth boundary.

Bt3—21 to 39 inches; red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm; few fine roots; few very fine and fine pores; few worm channels and casts; common clay films on faces of prisms one chroma darker than soil matrix; few scattered fine concretions of calcium carbonate in lower part; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk—39 to 62 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak coarse subangular blocky structure; slightly hard, friable; few fine roots; few very fine and fine pores; few fine concretions and threads of calcium carbonate; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Cd—62 to 80 inches; light red (2.5YR 6/6) noncemented sandstone, red (2.5YR 4/6) moist; massive; soft, very friable; few very fine concretions of calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Depth to concretions or films of calcium carbonate ranges from 16 to 44 inches. The upper 20 inches of the argillic horizon has 18 to 35 percent clay and less than 15 percent sand coarser than very fine sand.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Reaction is neutral or slightly alkaline.

The Bt horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. Texture is loam, silt loam, clay loam, or silty clay loam. The horizon is noneffervescent or slightly effervescent. Reaction is slightly alkaline to moderately alkaline.

The Bk horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is loam, silt loam, or very fine sandy loam. Carbonates range from barely visible to about 15 percent by volume of masses and concretions. The horizon ranges from slightly effervescent to violently effervescent. Reaction is moderately alkaline.

The Cd horizon is reddish noncemented sandstone or siltstone that has a texture of very fine sandy loam or silt loam. This material is mainly nonparalithic. It has high bulk density and is root restrictive. Carbonates range from barely visible to about 3 percent by volume of threads and masses. The horizon is slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

Quanah Series

The Quanah series consists of very deep, well drained, very gently sloping to moderately sloping soils on uplands. These soils formed in loamy calcareous materials. Permeability is moderate. Slopes range from 1 to 5 percent. The soils of the Quanah series are fine-silty, mixed, superactive, thermic Typic Calciustolls.

Quanah soils are commonly on the landscape near the Aspermont, Cottonwood, Jaywi, Knoco, Talpa, Tilvern, Vernon, and Westill soils. Aspermont and Jaywi soils do not have a mollic epipedon. Cottonwood, Knoco, and Talpa soils have sola less than 20 inches thick. Tilvern, Vernon, and Westill soils have more than 35 percent clay in the particle-size control section, and Westill soils have an argillic horizon.

Typical pedon of Quanah silty clay loam in an area of Quanah silty clay loam, 1 to 3 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 82, 3.2 miles east on Farm Road 1168; 3.0 miles east on Farm Road 3416; 9.7 miles southeast and east on county road; 3.0 miles north on ranch entrance road; 175 feet east on road, and 35 feet south of road in rangeland:

A—0 to 18 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable; many fine and medium roots; many fine and medium pores; common worm channels and casts; few fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—18 to 34 inches; brown (7.5YR 5/4) silty clay loam, brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable; few fine and medium roots; common fine pores; about 3 percent by volume films, threads, and concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—34 to 50 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few very fine and fine pores; about 5 percent by volume films, threads, and concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—50 to 66 inches; light reddish brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; common very fine and fine pores; about 20 percent by volume films, threads, and concretions of calcium carbonate; strongly effervescent; moderately alkaline; diffuse boundary.

Bk3—66 to 80 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, firm; few roots, few very fine and fine pores; about 20 percent by volume threads, masses, and concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to 80 inches or more. Thickness of the mollic epipedon is 10 to 20 inches. It is calcareous. Reaction is moderately alkaline.

The A horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 2 or 3.

The Bw horizon, where present, has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4. It is silty clay loam or loam. Volume of calcium carbonate ranges from 0 to 3 percent.

The Bk1 horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is loam or silty clay loam. Volume of calcium carbonate ranges from 5 to 10 percent.

The Bk2 and Bk3 horizons have hue of 5YR to 7.5YR, value of 5 or 6, and chroma of 4 to 6. They are loam or silty clay loam. Volume of calcium carbonate ranges from 15 to 40 percent.

Quinlan Series

The Quinlan series consists of shallow, well drained, soils on uplands. These soils formed in material weathered from soft calcareous sandstone and siltstone of Permian age. Permeability is moderate. Slopes range from 5 to 50 percent, but is dominantly less than 20 percent. The soils of the Quinlan series are loamy, mixed, superactive, thermic, shallow Typic Haplustepts.

Quinlan soils are commonly on landscapes with Cottonwood and Woodward soils. Cottonwood soils are underlain by beds of gypsum at very shallow and shallow depths. Woodward soils have sandstone between a depth of 20 to 40 inches.

Typical pedon of Quinlan very fine sandy loam in an area of Quinlan-Rock outcrop complex, 8 to 50 percent slopes; from the courthouse in Guthrie; 0.5 mile south on U.S. Highways 82 and 83, 9.3 miles west and southwest on county road, 1.1 miles west, 0.8 mile south, 1.0 mile west, 1.0 mile south, 0.32 mile west, 2.25 mile south, 1.9 miles west and southwest, and 50 feet northwest of road in rangeland:

A—0 to 4 inches; red (2.5YR 5/6) very fine sandy loam, red (2.5YR 4/6) moist; moderate fine granular structure; slightly hard, friable; common fine and medium roots; few worm channels and casts; surface has thin slightly brittle gypsum enriched crust; contains about 5 percent by volume of soft gypsum; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 11 inches; light red (2.5YR 6/6) very fine sandy loam, red (2.5YR 5/6) moist; weak fine subangular blocky structure; slightly hard, friable; common fine and few medium roots; few worm channels and casts; contains about 10 percent by volume of soft gypsum; slightly effervescent; moderately alkaline; gradual smooth boundary.

BC—11 to 16 inches; red (2.5YR 5/6) very fine sandy loam, red (2.5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few worm channels and casts; contains about 10 percent by volume of soft gypsum; few fragments of shale; slightly effervescent; moderately alkaline; gradual smooth boundary.

Cd—16 to 35 inches; red (2.5YR 5/6) noncemented sandstone, red (2.5YR 4/6) moist; massive, stratified; slightly hard, friable; few fine roots; contains about 10 percent by volume of soft gypsum; few fragments of shale; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 10 to 20 inches. Clay content ranges from 10 to 27 percent but is mainly between 17 and 20 percent. The horizons range from noneffervescent to strongly effervescent. Reaction is slightly alkaline.

The A horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 6. It is very fine sandy loam or loam. Calcium carbonate equivalent ranges from 0 to 10 percent by weight. Content of gypsum in the form of crystals or masses ranges from 0 to 5 percent.

The Bw and BC horizons have hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Texture is loam, very fine sandy loam, or silt loam. Content of calcium carbonate as nodules, masses, and threads ranges from 0 to 15 percent by volume. Calcium carbonate equivalent ranges from 0 to 15 percent. Content of gypsum, in the form of crystals or masses, ranges from 0 to 15 percent.

The Cd horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. It is typically noncemented sandstone, but some pedons are underlain by siltstone or stratified with each. Seams of calcium carbonate in cracks are commonly present. Some pedons also contain seams of gypsum. This material is mainly nonparalithic; however a few areas contain paralithic strata. It has high bulk density and is root restrictive.

Shrewder Series

The Shrewder series consists of very deep, well drained, very gently sloping and gently sloping soils on uplands. They formed in eolian and alluvial sediments of Pleistocene age. Permeability is moderately rapid. Slopes range from 1 to 5 percent. The soils of the Shrewder series are coarse-loamy, mixed, superactive, thermic Typic Haplustepts.

Shrewder soils are commonly on the landscape with Grandfield, Hardeman, and Woodward soils. Grandfield soils are on surrounding terraces and have an argillic horizon with more than 18 percent clay in the particle-size control section. Hardeman soils are on low terraces above a flood plain and have secondary carbonates near the surface. Woodward soils are on nearby residual uplands and are underlain by sandstone at depths less than 40 inches.

Typical pedon of Shrewder very fine sandy loam in an area of Shrewder very fine sandy loam, 3 to 5 percent slopes; from the courthouse in Guthrie, 11.4 miles north on U.S. Highway 83, 3.15 miles west on Farm Road 193, 0.25 mile north on county road, and 175 feet west of county road in rangeland:

A1—0 to 9 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/3) moist; weak fine subangular blocky and weak medium granular structure; slightly hard, very friable; common fine and medium roots; few worm channels and casts; neutral; gradual smooth boundary.

A2—9 to 16 inches; reddish brown (5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; common fine and medium roots; few very fine and fine pores; few worm channels and casts; neutral; gradual smooth boundary.

Bw1—16 to 25 inches; reddish brown (2.5YR 4/4) very fine sandy loam, dark reddish brown (2.5YR 3/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; few very fine and fine pores; few worm channels and casts; slightly alkaline; gradual smooth boundary.

Bw2—25 to 51 inches; red (2.5YR 5/6) very fine sandy loam, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; few fine roots; few very fine pores; few worm channels and casts; slightly alkaline; gradual smooth boundary.

BC—51 to 60 inches; light red (2.5YR 6/6) very fine sandy loam, red (2.5YR 5/8) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; few very fine and fine pores; few fine concretions of calcium carbonate; few fragments of weathered brittle sandstone in lower part; noneffervescent; moderately alkaline; gradual smooth boundary.

2Cd—60 to 80 inches; light red (2.5YR 6/8) noncemented sandstone, common discontinuous strata of white (5YR 8/1) noncemented sandstone; massive; slightly brittle, friable; few fine roots; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to secondary carbonates ranges from 30 to 60 inches.

The A horizon has hue of 5YR, value of 4 or 5, and chroma of 3 or 4. Reaction ranges from slightly acid to slightly alkaline.

The Bw1 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is very fine sandy loam, loam, or fine sandy loam. Reaction is neutral to moderately alkaline.

The Bw2 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8. It is very fine sandy loam, fine sandy loam, or loam. The horizon is slightly effervescent. Reaction ranges from neutral to moderately alkaline.

The BC horizon has color similar to the Bw2 horizon. It is very fine sandy loam, fine sandy loam, or loam. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

The 2Cd horizon is reddish noncemented sandstone containing thin strata of white sandstone. Calcium carbonate equivalent ranges from 0 to 5 percent. Roots do not penetrate the sandstone because of high bulk density and the lack of fractures. The horizon is slightly effervescent or strongly effervescent. Reaction is moderately alkaline.

St. Paul Series

The St. Paul series consists of very deep, well drained, nearly level soils on uplands. These soils formed in sediments weathered from soft Permian sandstone. Permeability is moderately slow. Slopes are 0 to 1 percent. The soils of the St. Paul series are fine-silty, mixed, superactive, thermic Pachic Argiustolls.

St. Paul soils are commonly on the landscape with Carey, Paducah, and Woodward soils. Carey soils are on slightly higher positions and have a mollic epipedon less than 20 inches thick. Paducah and Woodward soils are on higher landscapes and do not have mollic epipedons.

Typical pedon of St. Paul silt loam in an area of St. Paul silt loam, 0 to 1 percent slopes; from the courthouse in Guthrie; 5.3 miles west on U.S. Highway 82, 6.1 miles north and northwest on county road, 0.57 mile south, 100 feet west, and 1,200 feet south of county road in rangeland:

A—0 to 18 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish brown (5YR 3/2) moist; weak fine subangular blocky structure; hard, friable; many fine and medium roots; few worm channels and casts; slightly alkaline; clear smooth boundary.

Bw—18 to 24 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; few worm channels and casts; slightly alkaline; gradual smooth boundary.

Bt—24 to 32 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; moderate fine subangular blocky structure; very hard, firm; few fine roots; few fine pores; few clay films on faces of peds; moderately alkaline; gradual smooth boundary.

Bk1—32 to 46 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, firm; few fine roots; common threads and medium concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—46 to 63 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; few fine roots; common fine and medium pores; common threads and medium concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

BC—63 to 80 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, firm; few fine roots; common fine pores; noneffervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The depth to secondary carbonates is 30 to 40 inches.

The A horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. Reaction is neutral or slightly alkaline.

The Bw and Bt horizons have a hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. Texture is silt loam, loam, silty clay loam, or clay loam. Clay content is 18 to 35 percent in the Bw horizon and 27 to 35 percent in the Bt horizon. Reaction ranges from neutral to moderately alkaline.

The Bk horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silt loam, loam, clay loam, or silty clay loam. Clay content is 20 to 40 percent. The horizon is slightly effervescent or strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The BC horizon has hue of 2.5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, or silty clay loam, and the clay content is 15 to 35 percent. The horizon is slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

Talpa Series

The Talpa series consists of very shallow and shallow, well drained, gently sloping to steep soils on uplands. These soils formed in material weathered from dolomitic limestone and mudstone of Permian age. Permeability is moderate. Slopes range from 1 to 30 percent. The soils of the Talpa series are loamy, mixed, superactive, thermic Lithic Calciustolls.

Talpa soils are commonly on the landscape with Aspermont, Cottonwood, Knoco, Quanah, and Vernon soils. Aspermont soils are on lower slopes and have a solum more than 40 inches thick. Cottonwood soils are underlain by gypsum. Knoco and Vernon soils have clayey particle-size control sections and are underlain by claystone at depths of less than 40 inches. Quanah soils are on lower concave areas and have a solum more than 60 inches thick.

Typical pedon of Talpa gravelly loam in an area of Talpa gravelly loam, 1 to 5 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 3.2 miles east on Farm Road 1168, 3.0 miles east on Farm Road 3416 to ranch road, 2.75 miles southeast on ranch road, 4.1 miles south on ranch road, 0.85 mile west on oil field road, 0.17 mile south, and 120 feet west of road in rangeland:

A—0 to 4 inches; brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; moderate very fine and fine subangular blocky and granular structure; hard, friable; many fine and medium roots; common fine and medium pores; worm channels and casts; about 15 percent by volume of limestone fragments 2 to 5 cm across; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 9 inches; brown (7.5YR 4/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate very fine and fine subangular blocky and granular structure; hard, firm; common fine and medium roots; common fine and medium pores; few worm channels and casts; about 20 percent by volume of limestone fragments 2 to 5 cm across; some fragments have secondary coatings of calcium carbonate on the lower side; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bk2—9 to 11 inches; brown (7.5YR 4/3) extremely flaggy loam, dark brown (7.5YR 3/3) moist; moderate very fine subangular blocky and granular structure; about 85 percent by volume of light gray (10YR 7/2) indurated limestone flagstones with very pale brown (10YR 8/2) and pink (7.5YR 8/4) strongly cemented calcium carbonate pendants 1 to 8 cm thick on upper and lower surfaces; the fine earth fraction is 2 mm to 2 cm thick between fragments; many fine and medium roots; common fine calcium carbonate concretions; discontinuous and fractured coats of cemented calcium carbonate up to 2 cm thick on the bedrock and in some cracks and crevices of the bedrock; strongly effervescent; moderately alkaline; abrupt wavy boundary.

R—11 to 53 inches; very pale brown (10YR 8/2) indurated fractured limestone bedrock; fractures up to 2 cm wide and 1 to 2 feet apart; most cracks filled with cemented calcium carbonate, others contain soil and roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Cdk1—53 to 71 inches; olive gray (5Y 5/2) mudstone bedrock that has clay texture, olive gray (5Y 4/2) moist; massive; rock structure with many fractures; few streaks of weak red (10R 4/3); few masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cdk2—71 to 80 inches; weak red (10R 4/3) mudstone bedrock that has clay texture, dusky red (10R 3/3) moist; massive; rock structure with many fractures; few masses of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum and depth to strongly cemented to indurated limestone bedrock ranges from 4 to 20 inches and typically it is 5 to 11 inches. The particle-size control section contains 10 to 35 percent limestone gravel and channers, and 5 to 20 percent limestone cobbles, flagstones, and stones. Secondary calcium carbonate accumulations are films, threads, and pendants on the limestone fragments and in fractures. Calcium carbonate equivalent ranges from 15 to 40 percent of the whole soil, including fragments less than 2 cm across.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. Texture is gravelly loam or gravelly clay loam. Weighted average clay content is 22 to 35 percent. Coarse fragments, in the form of dolomitic limestone or limestone coated with cemented calcium carbonate, range from 5 to 20 percent. The fragments are mainly gravel and cobble size, but stones are also included in the horizon.

The Bk1 horizon has hue of 5YR to 2.5Y, value of 3 to 5, and chroma of 2 or 3. Texture is clay loam, silty clay loam, or loam and their gravelly counterparts. Weighted average clay content is 20 to 35 percent. Coarse fragments, in the form of dolomitic limestone or limestone coated with cemented calcium carbonate, range from 15 to 35 percent. The fragments are mainly gravel and cobbles, but stones are also included.

The Bk2 horizon has a hue of 5YR to 2.5Y, value of 3 to 5, and chroma of 2 or 3, where present. Texture is clay loam, silty clay loam, or loam and their gravelly, cobbly, and flaggy counterparts. Weighted average clay content is 20 to 35 percent. Coarse fragments, in the form of dolomitic limestone or limestone coated with cemented calcium carbonate, range from 60 to 90 percent. The fragments are mainly gravel, cobbles, channers, and flagstones; but stones are also included. The fragments are mostly pendants of precipitated calcium carbonate surrounding dolomitic limestone fragments. Plates of indurated caliche up to 2 inches thick and 3 to 15 inches long are present in some pedons. Loamy soil material is between the fragments and comprises 5 to 20 percent of the layer.

The R layer is strongly cemented to indurated and fractured dolomitic limestone bedrock. Accumulated layer thickness is generally 1 to 5 feet, but can range up to 15 feet. The surface of the limestone is weathered and fractured. Cracks range from 4 inches to 4 feet apart. The limestone is capped with discontinuous coatings of calcium carbonate which plug most of the fractures. Plant roots penetrate the open fractures.

The Cdk horizon is mudstone bedrock in shades of red and gray, with soft masses of calcium carbonate.

Tilvern Series

The Tilvern series consists of deep, well drained, very gently sloping soils on uplands (fig. 24). These soils formed in clayey and mudstone sediments of Permian age. Permeability is very slow. Slopes range from 1 to 3 percent. The soils of the Tilvern series are fine, mixed, active thermic Vertic Haplustepts.

Tilvern soils are commonly on the landscape with Aspermont, Cottonwood, Knoco, Talpa, Vernon, and Westill soils. Aspermont soils are in concave lower slope areas and have fine-silty particle-size control sections. Cottonwood, Knoco, and Talpa soils are on more sloping areas and have sola less than 20 inches thick. Vernon soils have sola less than 40 inches thick. Westill soils are on nearly level areas and have mollic epipedons and argillic horizons.

Typical pedon of Tilvern clay loam in an area of Tilvern clay loam, 1 to 3 percent slopes; from the courthouse in Guthrie, 11.7 miles south on U.S. Highway 83, 0.62 mile east on Croton Creek Ranch entrance road, 0.1 mile south on pipeline road, and 120 yards west in rangeland:

A—0 to 5 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; many fine and medium roots; few worm channels and casts; slightly alkaline; clear wavy boundary.

Bw—5 to 12 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate coarse angular blocky structure parting to moderate fine angular blocky; very hard, firm; common fine and medium roots; few worm channels and casts; dark coatings on surfaces of coarse peds; few fine concretions of calcium carbonate; noneffervescent; moderately alkaline; gradual wavy boundary.

Bk1—12 to 28 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate coarse angular blocky structure parting to moderate fine and medium angular blocky; very hard, firm; few fine and medium roots; few worm channels and casts; common old crack fills contain loamy material; common large pressure faces; common fine and medium concretions of calcium carbonate; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Bk2—28 to 46 inches; reddish brown (2.5YR 5/4) silty clay, reddish brown (2.5YR 4/4) moist; many wedge-shaped peds tilted at 15 to 45 degrees from horizontal parting to moderate fine and medium angular blocky structure; very hard, firm; few fine roots; common fine and medium concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

BCk—46 to 53 inches; reddish brown (2.5YR 5/4) silty clay, reddish brown (2.5YR 4/4) moist; few medium distinct light olive gray (5Y 6/2) mottles; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; very hard, firm; few fine roots, common pockets of crystals of gypsum and masses of calcium carbonate; common fine and few medium concretions of calcium carbonate; few weathered mudstone fragments in lower part; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cd—53 to 80 inches; reddish brown (2.5YR 4/4) weakly consolidated mudstone; dark reddish brown (2.5YR 3/4) moist; rock-like structure composed of wedge-shaped aggregates that part to fine angular blocks; very hard, firm; common strata and mottles of light greenish gray (5GY 7/1); few thin red (2.5YR 5/6) loamy strata; few

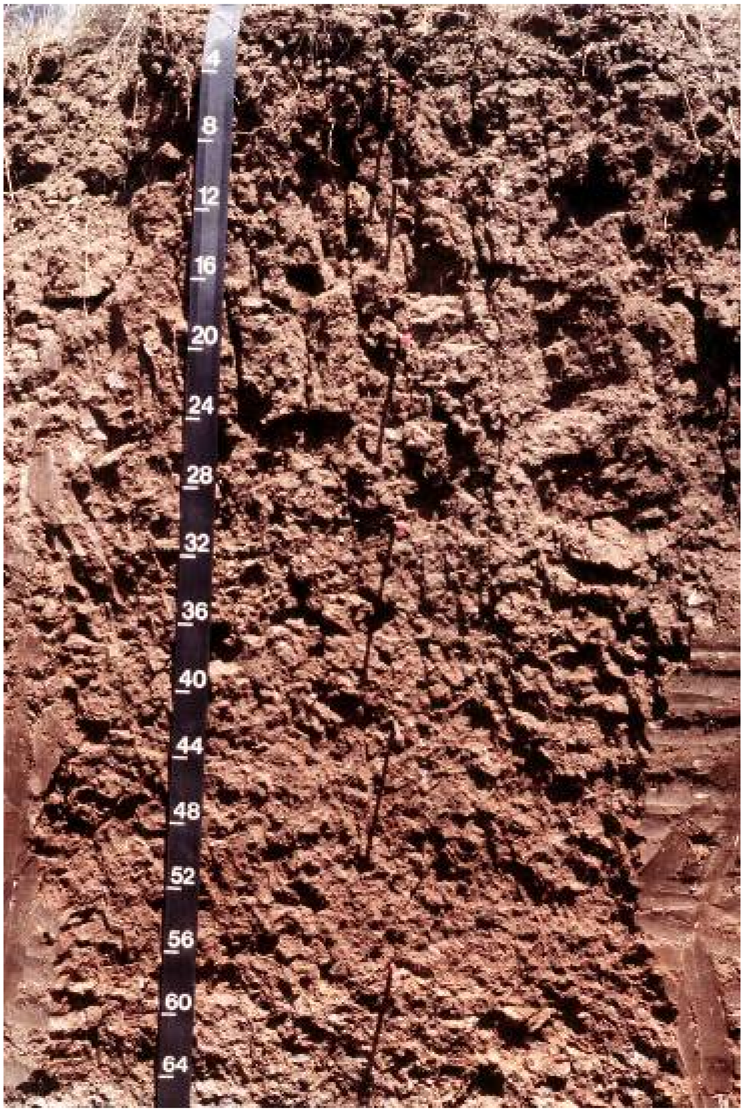

Figure 24.—Typical profile of Tilvern clay loam in an area of Tilvern clay loam, 1 to 3 percent slopes.

masses of calcium carbonate in upper part; common masses of gypsum crystals; slightly effervescent; moderately alkaline.

The thickness of the solum and depth to weathered mudstone ranges from 40 to 60 inches. Weighted average clay content of the particle-size control section ranges from 40 to 55 percent. During most years cracks 1/4- to 3/4-inch wide extend to a depth greater than 20 inches. Depth to wedge-shaped peds ranges from 24 to 35 inches. Linear extensibility ranges up to 3 inches in the upper 40 inches of the soil.

The A horizon has color with hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4. The horizon ranges from noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline. Thickness ranges from 2 to 8 inches.

The Bw horizon has color with hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4. Texture is clay, clay loam, or silty clay. The horizon ranges from noneffervescent to strongly effervescent. Reaction is moderately alkaline.

The Bk1 and Bk2 horizons have color with hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Texture is clay or silty clay. Wedge-shaped aggregates are common below a depth of 26 to 35 inches. Fine and medium concretions and masses of calcium carbonate range from few to common. Crystals of gypsum range from none to common in the Bk2 horizon. The horizons are slightly effervescent or strongly effervescent. Reaction is moderately alkaline.

The BCk horizon, where present, has color with hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. Texture is clay or silty clay. Mottles and stains in shades of gray and olive are common. These colors are inherited from the parent material. Concretions and masses of calcium carbonate and crystals of gypsum range from 5 to 15 percent. Weathered mudstone fragments are common to the lower part of the horizon. The horizon is strongly effervescent or violently effervescent. Reaction is moderately alkaline.

The Cd horizon has color with hue of 10R to 5YR, value of 4 or 5, and chroma of 4 to 6. Mottles and strata in shades of gray are common. It is weathered mudstone stratified with silty clay, or clay of Permian age. Some pedons contain thin strata of gypsum or broken dolomite. Wedge-shaped aggregates are common in some pedons. Masses and coatings of calcium carbonate range from none to common. Crystals of gypsum range from few to many. The horizon ranges from noneffervescent to strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

Vernon Series

The Vernon series consists of moderately deep, well drained, gently sloping to moderately sloping soils on uplands. These soils formed in Permian age clays and noncemented claystone. Permeability is very slow. Slopes range from 2 to 8 percent. The soils of the Vernon series are fine, mixed, active, thermic Typic Haplustepts.

Vernon soils are commonly on the landscape near Aspermont, Cottonwood, Knoco, Talpa, and Tilvern soils. Aspermont soils are in concave areas and have less than 35 percent clay in the particle-size control section. Cottonwood soils are less than 14 inches deep over gypsum. Knoco soils are less than 20 inches deep over noncemented claystone. Talpa soils are less than 20 inches deep over dolomitic limestone. Tilvern soils are on smoother upper slopes and have sola 40 to 60 inches deep.

Typical pedon of Vernon clay loam, in an area of Knoco-Vernon complex, 2 to 8 percent slopes; from the courthouse in Guthrie, 6.75 miles north on U.S. Highway 83, and 60 feet east of highway in rangeland:

A—0 to 4 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and very fine subangular blocky structure; very hard, very firm; many fine and medium roots; few worm channels and casts; few weathered hard fragments of calcium carbonate less than 1 cm across; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 10 inches; reddish brown (2.5YR 4/4) clay; dark reddish brown (2.5YR 3/4) moist; moderate fine and medium angular blocky structure; very hard, very firm; common fine roots; few worm channels and casts; few weathered hard fragments of calcium carbonate less than 1 cm across; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—10 to 23 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; few fine prominent light gray and light olive brown mottles; moderate fine and medium angular blocky structure; very hard, very firm; few fine and medium roots; common concretions of calcium carbonate; few weathered hard fragments of calcium carbonate as much as 2 cm across; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—23 to 29 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few fine light gray mottles; coarse angular blocky structure parting to moderate fine subangular blocky; very hard, very firm; few fine roots; few fine concretions and soft masses of calcium carbonate; few pockets of gypsum crystals; many weathered claystone fragments that become less weathered and more abundant with depth in shades of red and gray; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cd1—29 to 46 inches; red (2.5YR 4/6) noncemented claystone, dark red (2.5YR 3/6) moist; common medium prominent light gray (5Y 7/1) mottles; massive; rock structure with many fractures; extremely hard, very firm; few fine roots; few pockets of gypsum; slightly effervescent; moderately alkaline; gradual smooth boundary.

Cd2—46 to 80 inches; light gray (5Y 7/1) claystone, gray (5Y 6/1) moist; many fine black stains; massive; rock structure with many fractures; extremely hard, very firm; few masses and seams of soft calcium carbonate; slightly effervescent; moderately alkaline.

The thickness of the solum and the depth to red bed claystone and clays ranges from 20 to 40 inches. The horizons range from slightly effervescent to violently effervescent. Reaction is moderately alkaline.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6.

The Bw horizon, where present, has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay or silty clay.

The Bk and BCk horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay or silty clay with as much as 50 percent fragments of claystone in the BCk horizon. Concretions, soft masses, and films and threads of calcium carbonate range from few to about 10 percent by volume.

The Cd horizon has hue of 10R or 2.5YR, value of 4 or 5, and chroma of 4 to 6. It contains light gray and light olive gray mottles and strata. Some pedons contain thin discontinuous strata of dolomite. It is noncemented claystone that weathers to clay or silty clay texture.

Westill Series

The Westill series consists of deep, well drained, nearly level soils on uplands (fig. 25). These soils formed in thin mantles of clayey alluvium deposited over Permian age clays and mudstone. Permeability is very slow. Slopes are 0 to 1 percent. The soils of the Westill series are fine, mixed, superactive, thermic Vertic Argiustolls.

Westill soils are commonly on the landscape with Aspermont, Frankirk, Kingco, Tilvern, and Vernon soils. Aspermont soils are on convex slopes, have an ochric epipedon, and have less than 35 percent clay in the particle-size control section. Frankirk soils are on slightly higher surfaces and decrease by 20 percent or more clay content within 60 inches of the surface. Kingco soils are on concave surfaces and have gilgai microrelief. Tilvern and Vernon soils are on convex slopes and do not have mollic epipedons or argillic horizons. Vernon soils have sola less than 40 inches thick.

Typical pedon of Westill clay loam in an area of Westill clay loam, 0 to 1 percent slopes; from the courthouse in Guthrie, 13.5 miles north on U.S. Highway 83, 3.2 miles east on Farm Road 1168, 3.0 miles east on Farm Road 3416 to county road, 2.75 miles southeast on county road, 1.65 miles south on county road, 0.6 mile southwest on oil field road, 0.45 mile south, 0.45 mile east, 0.5 mile north, and 30 feet east in rangeland:

A—0 to 10 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky structure; very hard, firm; common fine and medium roots; slightly alkaline; clear smooth boundary.

Bt1—10 to 15 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine roots; common clay films on faces of prisms; few fine concretions of calcium carbonate; noneffervescent; moderately alkaline; clear smooth boundary.

Bt2—15 to 22 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; strong coarse prismatic structure parting to strong medium angular blocky; very hard,

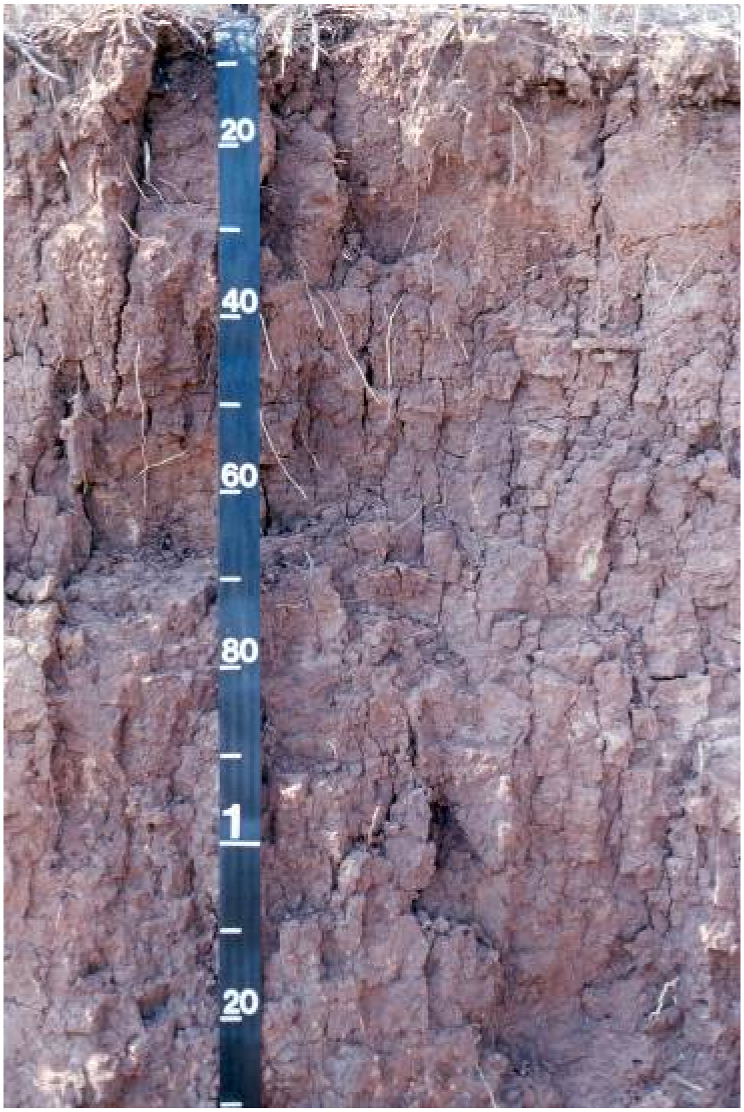

Figure 25.—Typical profile of Westill clay loam in an area of Westill clay loam, 0 to 1 percent slopes.

very firm; few fine roots; common clay films one chroma darker than soil matrix; few pressure faces; vertical cracks extending through horizon are filled with darker material; common very fine and fine concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Btkss1—22 to 49 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/3) moist; moderate coarse angular blocky structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine roots; common clay films 1/2 chroma darker than soil matrix; common distinct slickensides; vertical cracks extending through horizon are filled with darker material; common concretions of calcium carbonate as much as 5 mm across; strongly effervescent; moderately alkaline; clear smooth boundary.

Btkss2—49 to 58 inches; reddish brown (2.5YR 4/4) clay, reddish brown (2.5YR 4/3) moist; moderate coarse angular blocky structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine roots; common distinct slickensides; vertical cracks extending through horizon are filled with darker material;

about 15 percent masses and concretions of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.

Cd1—58 to 75 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; common thin strata of reddish brown (5YR 5/4) and light olive gray (5Y 6/2) noncemented mudstone; massive; very hard, very firm; few concretions and soft masses of calcium carbonate in upper part; few crystals of gypsum; very slightly effervescent; moderately alkaline; clear smooth boundary.

Cd2—75 to 80 inches; stratified reddish brown (5YR 5/4) and light olive gray (5Y 6/2) noncemented mudstone; massive; extremely hard, very firm; few crystals of gypsum; noneffervescent; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches and corresponds to depth to Permian age materials. Secondary carbonates are within 24 inches. The mollic epipedon extends into the Bt horizon in some pedons. Most pedons have a few small slickensides or small wedge-shaped peds. Some pedons have a minimal calcic horizon below a depth of 40 inches. Siliceous pebbles range from none to about 10 percent in the upper part of the pedon.

The A horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. Reaction ranges from neutral to moderately alkaline. The soil is generally noncalcareous to a depth of at least 10 inches.

The Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 2 to 6. Chroma increases with depth. The Bt horizon is clay loam or clay. Clay content of the upper 20 inches averages 35 to 50 percent. Calcium carbonate in the lower part of the Bt horizon is in the form of concretions, films, threads, and pipings. Reaction is mainly moderately alkaline, but some pedons are slightly alkaline in the upper part.

The Btkss horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Texture is clay, clay loam, or silty clay loam. Carbonates occur in the form of concretions, films, threads, or masses. Calcium carbonate equivalent ranges from 5 to 20 percent. Reaction is moderately alkaline.

The Cd horizon is clay loam, clay, and mudstone that have clay texture in shades of red, brown, gray, or green. Reaction is slightly alkaline or moderately alkaline.

Westola Series

The Westola series consists of very deep, well drained, nearly level soils on flood plains. These soils formed in loamy alluvium. Permeability is moderately rapid. Slopes are 0 to 1 percent. The soils of the Westola series are coarse-loamy, mixed, superactive, calcareous, thermic Typic Ustifluvents.

Westola soils are commonly on the landscape near Jester, Lincoln, and Yomont soils. Jester soils are on dunes above the flood plains and textures are loamy sand or coarser throughout. Lincoln soils are on lower elevations near stream channels and have a sandy particle-size control section. Yomont soils have less than 15 percent material that is coarser than very fine sand in the particle-size control section.

Typical pedon of Westola fine sandy loam in an area of Westola fine sandy loam, 0 to 1 percent slopes, frequently flooded; from the courthouse in Guthrie, 9.7 miles west on U.S. Highway 82, 1.4 miles south on county road, and 200 feet west in flood plain of South Wichita River:

A—0 to 4 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; few worm channels and casts; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—4 to 14 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; massive; slightly hard, friable; common fine roots; few worm channels and casts; common bedding planes; few strata of reddish brown very fine sandy loam as much as 3 inches thick; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2—14 to 80 inches; pink (5YR 7/4) fine sandy loam, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable; few fine roots, few worm channels and casts; many thinly bedded strata of fine sandy loam, loam, and loamy fine sand; slightly effervescent; moderately alkaline.

The horizons are slightly effervescent or strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The A horizon has hue of 5YR or 7.5YR, value or 4 to 6, and chroma of 2 to 6.

The C horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 8. It is fine sandy loam, very fine sandy loam, or loam. The C horizon has common thin strata of silt loam, very fine sandy loam, loam, and loamy fine sand. In some pedons below 40 inches, textures may be loamy fine sand or coarser.

Wheatwood Series

The Wheatwood series consists of very deep, well drained, nearly level soils on flood plains. These soils formed in calcareous loamy alluvium. Permeability is moderate. Slopes are 0 to 1 percent. The soils of the Wheatwood series are fine-silty, mixed, active, thermic Fluventic Haplustepts.

Wheatwood soils commonly are on landscapes near Beckman, Jaywi, and Yomont soils. Beckman soils are on the outer edges of flood plains and have more than 35 percent clay in the particle-size control section. Jaywi soils are on nearby uplands and do not have recent stratification. Yomont soils have less than 18 percent clay in the particle-size control section.

Typical pedon of Wheatwood loam in an area of Wheatwood loam, 0 to 1 percent slopes, frequently flooded; from the courthouse in Guthrie, 11.7 miles south on U.S. Highway 83, 2.45 miles west on county road, 0.5 mile south, and 500 feet southeast in rangeland:

A—0 to 4 inches; reddish brown (5YR 4/4) loam, reddish brown (5YR 4/3) moist; weak fine subangular blocky structure; hard, firm; many fine and medium roots; common worm channels and casts; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw1—4 to 27 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine and few medium roots; few worm channels and casts; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bw2—27 to 44 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common fine roots; few worm channels and casts; many loam and very fine sandy loam strata as much as 4 inches thick; about 2 percent by volume of crystals of gypsum; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk—44 to 80 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; very hard, very firm; few fine roots; few thin loamy strata; about 5 percent by volume of crystals of gypsum; about 5 percent by volume of concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The particle-size control section ranges from 20 to 35 percent clay and contains less than 15 percent sand coarser than very fine sand. Some pedons contain stratification below a depth of 20 inches. The horizons are slightly effervescent to strongly effervescent. Reaction is moderately alkaline.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4.

The Bw and Bk horizons have hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 6. Texture is silt loam, loam, or silty clay loam.

Woodward Series

The Woodward series consists of moderately deep, well drained, very gently sloping to steep soils on uplands (fig. 26). These soils formed in the residuum of soft sandstone of Permian age. Permeability is moderate. Slopes range from 2 to 30 percent. The soils of the Woodward series are coarse-silty, mixed, superactive, thermic Typic Haplustepts.

Woodward soils are commonly on the landscape near Carey, Paducah, Quinlan, Shrewder, and St. Paul soils. Carey, Paducah, and St. Paul soils are on lower slopes. They are deeper and have more than 18 percent clay in the particle-size control section. Quinlan soils have bedrock within a depth of 20 inches. Shrewder soils are on terrace deposits and do not have bedrock within a depth of 40 inches.

Typical pedon of Woodward loam in an area of Woodward loam, 5 to 8 percent slopes; from the courthouse in Guthrie, 0.5 mile south on U.S. Highways 82 and 83, 4.9 miles west and southwest on county road, 1.95 miles south on ranch road, and 100 feet east of ranch road in rangeland:

A—0 to 12 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate medium granular and weak fine subangular blocky structure; slightly hard, friable; many fine, medium, and few coarse roots; many fine and common tubular pores; common worm channels and casts; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw—12 to 28 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure parting to moderate medium granular; slightly hard, friable; common fine and few medium roots; common fine and few medium pores; common worm channels and casts; few films and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—28 to 34 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak medium granular and subangular blocky structure; hard, friable; few fine roots; few films and common medium concretions of calcium carbonate; about 15 percent by volume of light gray weakly cemented fragments of sandstone; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cd1—34 to 56 inches; red (2.5YR 5/6) noncemented sandstone, red (2.5YR 4/6) moist; common fine light gray fragments of weakly cemented sandstone; massive; hard, friable; few fine roots; about 5 percent fragments and flakes of gypsum; few mudstone fragments in lower part; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cd2—56 to 80 inches; red (2.5YR 5/6) noncemented sandstone, dark red (2.5YR 3/6) moist; massive; hard, firm; about 15 percent fragments and flakes of gypsum; common threads and few fine concretions of calcium carbonate; common fragments of mudstone; few light gray fragments of weakly cemented sandstone; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. Depth to soft secondary calcium carbonate ranges from 10 to 30 inches. The horizons are slightly effervescent or strongly effervescent. Reaction is slightly alkaline or moderately alkaline.

The A horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. Content of calcium carbonate as nodules, masses, and threads ranges from 0 to 5 percent by volume.

The Bw or Bk horizons have hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 8. Texture is loam, silt loam, or very fine sandy loam. Content of calcium carbonate as nodules, masses, and threads ranges from 5 to 10 percent by volume. Calcium carbonate equivalent ranges from 2 to 15 percent by weight.

Figure 26.—Typical profile of Woodward loam in an area of Woodward loam, 5 to 8 percent slopes.

The Cd horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. It is stratified noncemented, reddish calcareous sandstone that has thin white and grayish strata and stains. This material is mainly nonparalithic. It has high bulk density and is root restrictive.

Yomont Series

The Yomont series consists of very deep, well drained, nearly level soils on flood plains. These soils formed in loamy alluvium. Permeability is moderately rapid. Slopes are 0 to 1 percent. The soils of the Yomont series are coarse-silty, mixed, superactive, calcareous, thermic Typic Ustifluvents.

Yomont soils are commonly on the landscape near Westola and Wheatwood soils. Westola soils have more than 15 percent sand that is coarser than very fine sand in the particle-size control section. Wheatwood soils have more than 18 percent clay in the particle-size control section.

Typical pedon of Yomont very fine sandy loam in an area of Yomont very fine sandy loam, 0 to 1 percent slopes, occasionally flooded; from the courthouse in Guthrie, 0.5 mile south on U.S. Highways 82 and 83, 4.9 mile west and southwest on county road, 3.0 miles south on ranch road, and 60 feet east of road in flood plain of North Croton Creek:

A—0 to 8 inches; reddish brown (5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine and medium granular structure; slightly hard, very friable; many fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C—8 to 80 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few fine roots; few distinct bedding planes; few strata of silt loam; few siliceous pebbles and gypsum fragments in lower part; slightly effervescent; moderately alkaline.

The horizons are slightly effervescent or strongly effervescent. Reaction is moderately alkaline.

The A horizon has hue of 5YR, value of 4 to 6, and chroma of 3 to 6.

The C horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 6. The 10- to 40-inch particle-size control section is very fine sandy loam, loam, or silt loam that contains thin strata of loamy or sandy soil materials. The average clay content in the particle-size control section is less than 18 percent, and less than 15 percent is coarser than very fine sand.

Formation of the Soil

In this section, the factors of soil formation are discussed and related to the soils in King County. In addition, the processes of soil formation and the surface geology of the survey area are described.

Factors of Soil Formation

The characteristics of a soil depend on the action and interaction of five major factors: parent material, climate, plant and animal life, relief, and time. All of these factors are important; however, some have more influence than others on the formation of a given soil. It is difficult to isolate and evaluate the effects of any one factor in most cases. The following paragraphs discuss each factor separately and the probable effects of each on soil formation.

Parent Material

Parent material is the rock or transported material in which a soil forms. It determines the chemical and mineral content of the soil. In King County, the parent material consists of sedimentary rocks of Permian age and unconsolidated sediments of Quaternary (Pleistocene and Holocene) age. Additional information about parent material is in the section, Surface Geology.

Climate

The climate of King County is warm and subhumid and has a definite effect on soil formation. Rainfall, evaporation, temperature, and wind are some of the influencing factors of climate. The limited amount of rainfall has not been great enough to leach the soils. As a result, most of the soils have a layer in which calcium carbonate has accumulated. Only in years with much higher than normal rainfall are the very deep soils wetted to below the plant root zone. Although climate is uniform throughout the county, local rainfall and steepness of slope can cause excessive runoff and greatly reduce infiltration of water.

Patterns of rainfall distribution cause the soils to be alternately wet and dry. When clayey soils, such as Kingco and Lazare, become dry they crack, allowing rainfall to wash some of the surface layer into the cracks. If wetting continues, the cracks swell shut. This alternate shrinking and swelling process causes churning within the soil. Other soils, such as Frankirk and Westill, have clayey horizons lower in the soil profile. Water detaches clay particles from the surface layer as it moves through the soil. These particles accumulate in lower layers as water movement slows.

Wind also affects the formation of the soils. The sandy soil material in which Jester and Nobscot soils formed was reworked by wind.

Plant and Animal Life

Vegetation, furbearing animals, micro-organisms, earthworms, other organisms, and (more recently) man contribute to the development of soils. Living organisms cause gains in organic matter and nitrogen in soils, gains or loses in plant nutrients, and changes in structure and porosity.

In King County, tall grasses had more influence on soil development than other plants. These grasses provided litter that protected the soil surface and added organic matter to form dark-colored surface horizons, as in Acme, Carey, Frankirk, Quanah, and St. Paul soils. The grass roots reached deeply into the soil and used minerals at lower depths. Lime, other minerals, and organic matter were distributed throughout the soil as the plants died and decomposed. The plant root channels left by decomposed plants increased the intake of water and provided greater aeration of the soil. Earthworms and other soil organisms fed on the decomposed roots. The borings of earthworms also helped channel water and air through the soil. Burrowing animals, such as worms, ants, gophers, prairie dogs, and badgers help mix soil and parent material.

Human activities have also affected soil formation. Areas of native and introduced grasses have been overgrazed by livestock. In areas that have been tilled, the content of organic matter has been reduced and plowpans have formed. Construction and excavation activities also alter soil formation.

Relief

Relief affects soil formation by its influence on drainage, erosion, plant cover, and soil temperature.

The relief in King County ranges from nearly level to very steep. On nearly level and gently sloping soils, such as Carey, Frankirk, and St. Paul, most rainfall enters the soil, allowing deep soil horizon development. Soils on steeper slopes, such as Quinlan and Woodward, formed in similar parent material, but natural erosion or rapid runoff has kept the surface layer thin and light-colored (low in organic matter content). Also, the solum of these soils is not as thick as that of soils formed on less sloping topography because they are naturally eroded almost as quickly as they are formed. Some soils, such as the nearly level Wheatwood, Westola, and Yomont, are affected by flooding that deposits younger sediments with each flooding event.

The moderately sloping to steep Talpa and Knoco soils that are on east- and north-facing slopes have a thicker and darker surface layer than those soils on south- and west-facing slopes. More organic matter accumulates where slopes are less exposed to sunlight and the soil temperature is lower.

Time

The length of time that the soil-forming factors have acted on the parent material determines, to a large degree, the characteristics of the soil. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of the soil horizons. Young soils have very little horizon development and old soils have well-expressed horizons. In King County, Beckman, Westola, and Yomont soils are examples of young soils. These soils retain most of the characteristics of their recently deposited parent material. Carey, Delwin, and Miles soils are examples of older soils that have well developed horizons. These soils have distinct A and B horizons that bear little resemblance to the original parent material.

Processes of Soil Formation

The formation of horizons in soils involves several processes, including accumulation of organic matter, leaching of calcium carbonates and calcium sulfates, and formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the surface layer helps to form an A horizon. The soils in the survey area range from low to high in organic matter content.

The amount of rainfall has been sufficient to cause leaching of carbonates to greater depths in the soil profile and to influence a downward movement of silicate clays in most of the soils. These processes contribute to the formation of soil horizons.

The Carey, Grandfield, Paducah, and St. Paul soils are examples of soils in which the downward translocation of clay minerals and carbonates has contributed to horizon development. The Bt horizon in these soils contains appreciably more silicate clay than the A horizon. The Bk horizons in the lower part of the solum contain masses, concretions, and threads of calcium carbonate. Leaching of calcium carbonate and downward movement of clay minerals are among the more important processes responsible for horizonation in the soils of the survey area.

Surface Geology

The Geologic Atlas of Texas, Lubbock Sheet and Wichita Falls-Lawton Sheet, and the Geologic Map of Texas depict the geologic outcrops in King County (Bureau of Economic Geology, 1967, 1987, and 1992). The oldest outcrops are Permian age, and they dominate the King County area. Younger sediments of Quaternary age occur on stream terraces and flood plains that were deposited during Pleistocene and Holocene time. The youngest geologic unit in King County is “Holocene windblown sand and silt” in the north-central part of the county on the boundary with Cottle County.

Quaternary stream channel dissection and surface runoff during Quaternary time have modified the landscape and had a profound influence on landscape evolution and the geomorphic surfaces associated with King County soils. The North Wichita River, Middle Fork Wichita River, and their tributaries drain the northern part of the county. The South Wichita River flows from west to east through the central sector of King County. Little Croton Creek, North Croton Creek, and Salt Croton Creek, all tributaries to the Salt Fork of the Brazos River, drain the southern third of the county. These streams and their tributaries have eroded sediments of late Tertiary and early Quaternary age and exposed the underlying Permian formations. Subsequent erosion and sediment deposition from water and wind have formed the current landscapes.

The maximum limits of the late Tertiary-age Ogallala Formation extended eastward beyond King County. Erosion of this overlying geologic formation of Miocene-Pliocene age and early Pleistocene strata, and the resulting westward retreat of the Caprock Escarpment, exposed Permian shales, sandstones, and evaporites. The eroded strata are a source of unmapped sand and gravel forming a thin mantle of residual sediment. This sediment has been reworked over time by alluvial, eolian, and colluvial erosion processes and has masked significant areas of Permian outcrop. Erosional processes have also contributed sediment for alluvial deposition active during Pleistocene time. The dominant components of Pleistocene stream terrace alluvium are reworked Permian and Tertiary clastic sediments. Clay, silt, and sand are the major constituents of Holocene flood plain deposits.

Permian strata and Quaternary fluvial and windblown sediments are the major sources of soil parent materials in King County. Shale and sandstone with thinly to massively bedded evaporites are the parent sediments for clayey and sandy soils, respectively. The wide range in texture for alluvium parent materials results in clayey to gravelly soils. Windblown (eolian) sediments are parent materials for sandy soils. Consequently, the general soil map depicts the general location and extent of Permian outcrops, Quaternary eolian and fluvial deposition, and related stream patterns.

Permian Formations and Associated Soils

Permian Formations cropping out in King County generally strike in a northerly direction, and dip at a low angle westward. There are no faults mapped in Permian Formation outcrops in King County (Bureau of Economic Geology, 1967, 1987, and 1992).

Permian strata cropping out in King County were deposited in a shallow sea that extended from central Kansas to southwestern Texas and northern Mexico (Sellards and others, 1932). Shale and sandstone (red beds), dolomite, and gypsum (evaporites) were deposited in an environment subjected to numerous episodes of submergence and desiccation. At the end of Permian time, the sea was completely dry.

From oldest to youngest, the Clear Fork Group, San Angelo Formation, Blaine Formation, Whitehorse Sandstone, and Quartermaster Formation crop out in King County. The Clear Fork Group outcrop is of very limited extent in the extreme southeastern corner of the county. The overlying San Angelo Formation crops out intermittently along the eastern county boundary. The eastern two-thirds of the county is dominated by the Blaine Formation outcrop. The Whitehorse Sandstone and the Quartermaster Formation crop out in the western one-third of the county. The Quartermaster Formation outcrop in King County is only a small area on the boundary between King County and Dickens County (Bureau of Economic Geology, 1967 and 1987).

Clear Fork Group, San Angelo Formation, and Blaine Formation

The Clear Fork Group and San Angelo Formation are combined with the Blaine Formation for soil mapping purposes due to outcrop locations, paucity of outcrop areas, similar lithologies, and stratigraphic proximity. The Clear Fork Group is mostly highly erodible shale with interbedded, massive, fine-grained, quartz sandstone. The San Angelo Formation is dominantly highly erodible thin bedded to massive, fine-grained quartz sandstone with sandy shale and conglomerates consisting of dolomite and siliceous limestone pebbles. The Badland-Knoco complex is typically mapped on the Clear Fork Group and San Angelo Formation. The extensive Blaine Formation outcrop in King County is primarily interbedded shale, gypsum, and dolomite. The shale is very thinly to massively bedded, calcareous, and selenitic. Gypsum beds are contorted and thin to massive. Dolomite members mapped in King County are, from oldest to youngest, Mangum Dolomite, Acme Dolomite, Guthrie Dolomite, and an unnamed stratum. The surface associated with the Blaine Formation outcrop is strongly dissected and deeply incised by fluvial erosion in contrast to the younger more subdued landforms and topography on the overlying White Horse Sandstone outcrop.

The Blaine Formation is dissected and deeply incised by the Middle Fork of the Wichita River, South Wichita River, North Croton Creek, and their tributaries. This fluvial erosion, in essentially the eastern portion of the county, is occurring on older topography and landforms with undulating to very steep slopes (Bureau of Economic Geology, 1967 and 1987; Soil Survey Staff, 1993). Typically, Aspermont soils have developed on backslope positions of ridges and mesas while Nipsum and Quanah soils formed in colluvium and slope alluvium on lower footslopes. Tilvern soils are on shoulder and backslope positions and Talpa soils developed on summits and hillslopes. The Talpa-Knoco-Rock outcrop complex, Cottonwood-Knoco complex, and Rock outcrop-Cottonwood complex soils are mapped on severely eroded and deeply incised landscapes.

Upstream in the central and north-central sections of the county, the interfluves are wider and stream channels are not incised as deeply as those to the east. The topography is much more subdued with mostly nearly level to rolling slopes (Bureau of Economic Geology, 1967 and 1987; Soil Survey Staff, 1993). Younger karst topography is present with shallow sinkholes, closed depressions, and relict lake basins. The Talpa-Quanah complex is mapped on karst topography. The shallow depressions are thought to be relict Pleistocene lake basins where Lazare soils are mapped. Stream channels in the central and south-central sections of the county are incised with a rolling topography. The Badland-Knoco complex and Knoco-Vernon complex are mapped on geologically eroding landscapes.

The Talpa-Knoco, Cottonwood-Knoco, and Tilvern-Westill general soil map units are delineated over the Clear Fork Group, San Angelo Formation, and Blaine Formation.

Whitehorse Sandstone and Quartermaster Formation

The Quartermaster Formation is combined with the Whitehorse Sandstone in King County for soil mapping purposes. The relatively small Quartermaster Formation outcrop and lithologic similarities with the Whitehorse Sandstone are the principal factors for this combination. The strata are composed of thin bedded to massive, friable, fine-grained quartz sandstone, and indistinctly bedded to massive sandy shale. The Escota Gypsum member is mapped separately in this area (Bureau of Economic Geology, 1967 and 1987). Other unnamed and unmapped massive gypsum members with thin discontinuous beds of dolomite also crop out in King County.

The Whitehorse Sandstone is drained by upstream segments or headwaters of the North Wichita River, South Wichita River, North Croton Creek, Salt Croton Creek, and their tributaries. Stream channel density and dissection is similar to the Blaine Formation. However, channel incisement is less. Broad interfluves, which are comparable to those on the Blaine Formation, are in the northwest section of the county and have wide shallow depressions believed to be relict Pleistocene lake basins. St. Paul soils are mapped in these ancient basins. Dominant upland soils developed over the Whitehorse Formation are Woodward, Paducah, Carey, and Quinlan series. Woodward and Quinlan soils formed in residuum weathered from very fine-grained sandstone on very gently sloping to very steep summit, shoulder, and backslope positions. Carey and Paducah soils developed in residuum weathered from sandstone and siltstone on slightly concave and convex areas, respectively. Rough broken land, typically under severe geologic erosion, is delineated over slightly weathered sandstone that commonly contains thin, soft, erosive shale.

The Woodward-Quinlan and Woodward-Paducah-Carey general soil map units are delineated over the Whitehorse Sandstone and Quartermaster Formation.

Quaternary-Age Sediment and Associated Soils

Quaternary-age sediment in King County is mapped as Pleistocene fluviatile terrace deposits, Holocene floodplain alluvium, and Holocene windblown sand and silt sheet deposits (Bureau of Economic Geology, 1967 and 1987). Locations of the fluvial sediments and associated soil parent materials are determined by stream channel locations. The eolian upland deposits were derived principally from stream channel and floodplain sand and silt.

Fluviatile Terrace Deposits

Pleistocene-age fluviatile terrace deposits are the remnants of ancient flood plains along major streams. These deposits are mostly sand and silt. Pebbles and cobbles of chert, quartzite, igneous and metamorphic rock, and caliche are common. Cross-bedded to massive, lenticular quartz sand is present at higher elevations. Stream channel entrenchment and other erosional processes have left the relict terraces above and on the periphery of younger Holocene flood plains. At least three levels of Pleistocene flood plain deposition occurred prior to stream entrenchment. Westill soils developed on the oldest or highest level. Nobscott and Delwin soils are also present on high stream terrace levels that are overblown with wind-reworked, sandy sediments. The higher level terraces include some of the masked Permian outcrop area previously mentioned. Grandfield and Shrewder soils are mapped mostly on the middle and lower Pleistocene stream terrace levels. The Devol series is generally on the lower level terraces above or adjacent to Holocene flood plains.

The Grandfield-Shrewder-Devol general soil map unit is located over fluviatile terrace deposits in King County.

Alluvium

Holocene alluvium is mapped along the North Wichita River, South Wichita River, Salt Croton Creek, and North Croton Creek (Bureau of Economic Geology, 1967 and 1987). These unconsolidated flood plain sediments include gravel, sand, clay, and silt. Lincoln, Beckman, Wheatwood, Westola, and Yomont soils developed in these parent materials.

Windblown Sand and Silt Sheet Deposits

Upland sandy and loamy sand soils have developed southeast of the North Wichita River in the extreme north-central section of the county. This area is characterized by eolian sand and silt derived mostly from sandy river channels and flood plains. The Delwin-Nobscot general soil map unit is mapped on Holocene windblown sand and silt sheet deposits.

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the "National Soil Survey Handbook" (available in local offices of the Natural Resources Conservation Service or on the Internet).

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

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.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone. A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan. A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium. Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha, alpha-dipyridyl. A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect. The direction toward which a slope faces. Also called slope aspect.

Association, soil. A group of soils or miscellaneous areas 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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp. A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland. A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada. A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology). A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane. A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Bottom land. An informal term loosely applied to various portions of a flood plain.

Boulders. Rock fragments larger than 2 feet (60 cm) across.

Breaks. A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. See Terracettes.

Cement rock. Clayey limestone used in the manufacture of cement.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 cm) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter across. 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 depletions. See Redoximorphic features.

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.

Claypan. A dense, compact, slowly permeable subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community. 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.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 cm) across.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 cm) across. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are compounds making up concretions. See Redoximorphic features.

Conglomerate. A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 mm across. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

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.

Coppice dune. See Shrub-coppice dune.

Coprogenous earth (sedimentary peat). A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology). A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations). Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cuesta. An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

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 resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement. A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth. A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw. A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill. See Mine spoil.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological 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 ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit. Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of 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 (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

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 pavement. A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface. A land surface shaped by the action of erosion, especially by running water.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant. A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 cm) long.

Flood plain. The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms. A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay. A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step. An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial. Of or pertaining to rivers or streams; produced by stream or river action.

Foothills. A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope. The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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 microlows (microbasins) and microhighs (microknolls) in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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 as much as 3 inches (2 mm to 7.6 cm) across. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 cm) across.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim (in tables). Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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.

Head slope (geomorphology). A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope. A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

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 uppercase letter represents the major horizons. Numbers or lowercase 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.

L horizon.—A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

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.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology). A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream. A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. See Redoximorphic features.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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.

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.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

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.

Karst (topography). A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Ksat. Saturated hydraulic conductivity. (See Permeability.)

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 cm) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

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.

Loess. Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength. The soil is not strong enough to support loads.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Mass movement. A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. See Redoximorphic features.

Meander belt. The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar. A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll. One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline.

Mine spoil. An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. A kind of map unit that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 mm (about 0.2 inch); medium, from 5 to 15 mm (about 0.2 to 0.6 inch); and coarse, more than 15 mm (about 0.6 inch).

Mountain. A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. See Redoximorphic features.

Nose slope (geomorphology). A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Paleoterrace. An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

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 movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0015 inch
Very slow	0.0015 to 0.06 inch
Slow	0.06 to 0.2 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

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology). A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings. See Redoximorphic features.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed as 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 degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations. See Redoximorphic features.

Redoximorphic depletions. See Redoximorphic features.

Redoximorphic features. Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:

a. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; and

b. Masses, which are noncemented concentrations of substances within the soil matrix; and

c. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.

2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:

a. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; and

b. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).

3. Reduced matrix.—This is a soil matrix that has low chroma in situ but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix. See Redoximorphic features.

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief. The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill. A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser. The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 mm or more; for example, pebbles, cobbles, stones, and boulders.

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.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 mm across. 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-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat). See Permeability.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock. A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell (in tables). 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.

Shrub-coppice dune. A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology). A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range across 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.

Siltstone. An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic). Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 40 percent
Very steep	45+ percent

Classes for complex slopes are as follows:

Nearly level	0 to 3 percent
Gently undulating	1 to 5 percent
Undulating	1 to 8 percent
Rolling	5 to 10 percent
Strongly rolling	5 to 16 percent
Hilly	10 to 30 percent
Steep	20 to 45 percent
Very steep	45+ percent

Slope alluvium. Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na+ to Ca ++ + Mg++. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 and by the passage of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes, in mm, of separates recognized in the United States are as follows:

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, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones. Rock fragments 10 to 24 inches (25 to 60 cm) across if rounded or 15 to 24 inches (38 to 60 cm) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Strath terrace. A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion 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 erosion 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.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. See Underlying material.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the 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.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 cm). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

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. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace (conservation). 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 water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes. Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is 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.

Toeslope. The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread. The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff. A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland. An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Underlying material. The part of the soil below the solum.

Valley fill. The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded for the period 1971-2000 at Guthrie, Texas)

	Temperature (Degrees F)						Precipitation (Inches)				
				2 years in 10 will have		Average number of growing degree days*		2 years in 10 will have		Average number of days w/.1 or more	Average total snow fall
Month	Average daily maximum	Average daily minimum	Average	Maximum temp. > than	Minimum temp. < than		Average	less than	more than		
January	54.6	24.9	39.7	81	6	19	1.10	0.24	1.87	2	2.1
February	59.9	29.2	44.6	86	7	52	1.44	0.27	2.71	3	1.4
March	68.9	36.5	52.7	94	17	164	1.27	0.31	2.09	2	0.1
April	78.2	44.8	61.5	98	26	357	1.79	0.50	2.98	3	0.0
May	86.0	55.7	70.9	105	39	644	3.83	1.51	5.65	5	0.0
June	92.9	64.4	78.7	108	51	859	3.31	1.57	4.88	5	0.0
July	97.1	68.5	82.8	108	58	1,016	1.97	0.29	3.40	3	0.0
August	95.7	67.2	81.5	107	57	965	2.95	1.03	4.54	4	0.0
September	88.2	59.6	73.9	104	39	712	3.15	0.62	5.70	4	0.0
October	78.9	47.8	63.3	98	28	417	2.37	0.32	3.89	3	0.0
November	65.6	35.1	50.4	88	17	121	1.12	0.25	1.81	2	0.7
December	55.7	26.5	41.1	80	6	21	1.04	0.16	1.70	2	0.7
Yearly:											
Average	76.8	46.7	61.7	---	---	---	---	---	---	---	---
Extreme	119	-10	---	112	1	---	---	---	---	---	---
Total	---	---	---	---	---	5,347	25.34	19.38	28.53	38	5.1

Average number of days per year with at least 1 inch of snow on the ground: 3

*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 (Threshold: 50.0 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded for the period 1971-2000 at Guthrie, Texas)

	Temperature		
Probability	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 28	April 11	April 17
2 years in 10 later than--	March 21	April 5	April 13
5 years in 10 later than--	March 8	March 25	April 6
First freezing temperature in fall:			
1 year in 10 earlier than--	November 2	October 27	October 23
2 years in 10 earlier than--	November 7	October 31	October 27
5 years in 10 earlier than--	November 18	November 9	November 4

Table 3.--Growing Season

(Recorded for the period 1971-2000 at Guthrie, Texas)

	Daily Minimum Temperature		
Probability	Number of days Greater than		
	24°F	28°F	32°F
9 years in 10	229	209	194
8 years in 10	238	216	200
5 years in 10	255	230	212
2 years in 10	271	244	224
1 year in 10	280	251	230

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AcA	Acme loam, 0 to 1 percent slopes	960	0.2
AsC	Aspermont silty clay loam, 2 to 5 percent slopes	3,241	0.6
BKF	Badland-Knoco complex, 2 to 20 percent slopes	15,599	2.7
BmA	Beckman clay, 0 to 1 percent slopes, frequently flooded	1,199	0.2
CaA	Carey loam, 0 to 1 percent slope	11,368	1.9
CKF	Cottonwood-Knoco complex, 3 to 20 percent slopes	77,634	13.3
DeC	Delwin sand, 1 to 5 percent slopes	4,239	0.7
DvD	Devol loamy sand, 3 to 8 percent slopes	1,881	0.3
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	5,913	1.0
EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes	1,114	0.2
FoA	Foursixes clay loam, 0 to 1 percent slopes	2,074	0.4
FrB	Frankirk loam, 0 to 2 percent slopes	2,612	0.4
GdB	Grandfield loamy sand, 0 to 3 percent slopes	4,884	0.8
GdC2	Grandfield loamy sand, 2 to 5 percent slopes, moderately eroded	655	0.1
GfB	Grandfield fine sandy loam, 1 to 3 percent slopes	7,659	1.3
GfC	Grandfield fine sandy loam, 3 to 5 percent slopes	3,028	0.5
HaC	Hardeman fine sandy loam, 1 to 5 percent slopes	1,360	0.2
JaC	Jaywi silty clay loam, 2 to 5 percent slopes	5,890	1.0
JeE	Jester loamy sand, 3 to 12 percent slopes	683	0.1
KgA	Kingco silty clay loam, 0 to 1 percent slopes	2,215	0.4
KVD	Knoco-Vernon complex, 2 to 8 percent slopes	25,356	4.3
LaA	Lazare clay, 0 to 1 percent slopes, occasionally ponded	228	*
LnA	Lincoln soils, 0 to 1 percent slopes, frequently flooded	1,066	0.2
M-W	Miscellaneous water	237	*
MfA	Miles fine sandy loam, 0 to 1 percent slopes	990	0.2
NoC	Nobscot sand, 1 to 5 percent slopes	2,692	0.5
NpB	Nipsum silty clay, 0 to 2 percent slopes	955	0.2
ObC	Obaro loam, 1 to 4 percent slopes	2,616	0.4
PdB	Paducah loam, 1 to 3 percent slopes	31,443	5.4
QnB	Quanah silty clay loam, 1 to 3 percent slopes	7,418	1.3
QTD	Quanah-Talpa complex, 3 to 8 percent slopes	11,807	2.0
QUG	Quinlan-Rock outcrop complex, 8 to 50 percent slopes	11,725	2.0
RCG	Rock outcrop-Cottonwood complex, 20 to 45 percent slopes	18,582	3.2
ShB	Shrewder very fine sandy loam, 1 to 3 percent slopes	1,923	0.3
ShC	Shrewder very fine sandy loam, 3 to 5 percent slopes	5,187	0.9
SpA	St. Paul silt loam, 0 to 1 percent slopes	6,304	1.1
TaC	Talpa gravelly loam, 1 to 5 percent slopes	27,952	4.8
TKG	Talpa-Knoco-Rock outcrop complex, 5 to 30 percent slopes	61,278	10.5
TQB	Talpa-Quanah complex, 0 to 3 percent slopes	14,826	2.5
TvB	Tilvern clay loam, 1 to 3 percent slopes	36,632	6.3
W	Water	543	*
WcA	Westill clay loam, 0 to 1 percent slopes	30,723	5.3
WeA	Westola fine sandy loam, 0 to 1 percent slopes, occasionally flooded	881	0.2
WfA	Westola fine sandy loam, 0 to 1 percent slopes, frequently flooded	3,557	0.6
WhA	Wheatwood loam, 0 to 1 percent slopes, frequently flooded	5,967	1.0
WoC	Woodward loam, 2 to 5 percent slopes	38,126	6.5
WoD	Woodward loam, 5 to 8 percent slopes	11,258	1.9
WQF	Woodward-Quinlan complex, 5 to 15 percent slopes	35,033	6.0
WQG	Woodward-Quinlan-Rough broken land complex, 5 to 45 percent slopes	28,770	4.9
YmA	Yomont very fine sandy loam, 0 to 1 percent slopes, occasionally flooded	3,739	0.6
YtA	Yomont very fine sandy loam, 0 to 1 percent slopes, frequently flooded	2,926	0.5
	Total	584,948	100.0

* Less than 0.1 percent.

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

Map Symbol	Map unit name	Farmland Classification
AsC	Aspermont silty clay loam, 2 to 5 percent slopes	All areas are prime farmland
CaA	Carey loam, 0 to 1 percent slopes	All areas are prime farmland
EnB	Enterprise very fine sandy loam, 1 to 3 percent slopes	All areas are prime farmland
EnC	Enterprise very fine sandy loam, 3 to 5 percent slopes	All areas are prime farmland
FrB	Frankirk loam, 0 to 2 percent slopes	All areas are prime farmland
KgA	Kingco silty clay loam, 0 to 1 percent slopes	All areas are prime farmland
PdB	Paducah loam, 1 to 3 percent slopes	All areas are prime farmland
QnB	Quanah silty clay loam, 1 to 3 percent slopes	All areas are prime farmland
SpA	St. Paul silt loam, 0 to 1 percent slopes	All areas are prime farmland
YmA	Yomont very fine sandy loam, 0 to 1 percent slopes, occasionally flooded	All areas are prime farmland
AcA	Acme loam, 0 to 1 percent slopes	Prime farmland if irrigated
GfB	Grandfield fine sandy loam, 1 to 3 percent slopes	Prime farmland if irrigated
GfC	Grandfield fine sandy loam, 3 to 5 percent slopes	Prime farmland if irrigated
HaC	Hardeman fine sandy loam, 1 to 5 percent slopes	Prime farmland if irrigated
MfA	Miles fine sandy loam, 0 to 1 percent slopes	Prime farmland if irrigated
NpB	Nipsum silty clay, 0 to 2 percent slopes	Prime farmland if irrigated
ShB	Shrewder very fine sandy loam, 1 to 3 percent slopes	Prime farmland if irrigated
ShC	Shrewder very fine sandy loam, 3 to 5 percent slopes	Prime farmland if irrigated
WcA	Westill clay loam, 0 to 1 percent slopes	Prime farmland if irrigated
WeA	Westola fine sandy loam, 0 to 1 percent slopes, occasionally flooded	Prime farmland if irrigated
WoC	Woodward loam, 2 to 5 percent slopes	Prime farmland if irrigated

Table 6.--Irrigated and Nonirrigated Yields by Map Unit

(Yields in the "N" columns are for nonirrigated areas; those in the "I" columns are for irrigated areas. 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.)

Map symbol and soil name	Land capability		Cotton lint		Grain sorghum		Wheat	
	N	I	N	I	N	I	N	I
			Lbs	Lbs	Bu	Bu	Bu	Bu
AcA:								
Acme	3s	---	---	---	---	---	---	---
AsC:								
Aspermont	3e	---	150.00	---	26.00	---	16.00	---
BKF:								
Badland	8e	---	---	---	---	---	---	---
Knoco	7s	---	---	---	---	---	---	---
BmA:								
Beckman	5w	---	---	---	---	---	---	---
CaA:								
Carey	2c	---	300.00	750.00	35.00	110.00	25.00	55.00
CKF:								
Cottonwood	7s	---	---	---	---	---	---	---
Knoco	7s	---	---	---	---	---	---	---
DeC:								
Delwin	4e	---	175.00	---	25.00	---	15.00	30.00
DvD:								
Devol	4e	---	175.00	---	25.00	---	15.00	---
EnB:								
Enterprise	2e	---	350.00	650.00	35.00	90.00	25.00	50.00
EnC:								
Enterprise	3e	---	250.00	550.00	30.00	75.00	20.00	45.00
FoA:								
Foursixes	3s	---	300.00	---	40.00	---	30.00	---
FrB:								
Frankirk	2e	---	350.00	700.00	40.00	80.00	25.00	55.00
GdB:								
Grandfield	3e	---	250.00	---	30.00	---	20.00	---
GdC2:								
Grandfield, moderately eroded	4e	---	150.00	---	15.00	---	10.00	---
GfB:								
Grandfield	2e	---	300.00	---	30.00	---	20.00	---
GfC:								
Grandfield	3e	---	250.00	---	30.00	---	20.00	---
HaC:								
Hardeman	3e	---	200.00	500.00	25.00	50.00	15.00	40.00
JaC:								
Jaywi	3e	---	---	---	---	---	---	---

Table 6.--Irrigated and Nonirrigated Yields by Map Unit--Continued

Map symbol and soil name	Land capability		Cotton lint		Grain sorghum		Wheat	
	N	I	N	I	N	I	N	I
			Lbs	Lbs	Bu	Bu	Bu	Bu
JeE:								
Jester	6e	---	---	---	---	---	---	---
KgA:								
Kingco	2s	---	330.00	725.00	30.00	85.00	30.00	55.00
KVD:								
Knoco	6s	---	---	---	---	---	---	---
Vernon	4e	---	---	---	---	---	---	---
LaA:								
Lazare	3w	---	---	---	---	---	---	---
LnA:								
Lincoln	5w	---	---	---	---	---	---	---
M-W:								
Water, miscellaneous	---	---	---	---	---	---	---	---
MfA:								
Miles	2e	---	330.00	700.00	35.00	85.00	30.00	55.00
NoC:								
Nobscot	4e	---	200.00	---	25.00	---	15.00	---
NpB:								
Nipsum	2e	---	250.00	---	25.00	---	15.00	---
ObC:								
Obaro	4e	---	200.00	---	26.00	---	16.00	---
PdB:								
Paducah	2e	---	250.00	650.00	30.00	90.00	18.00	45.00
QnB:								
Quanah	2e	---	200.00	---	25.00	---	20.00	---
QTD:								
Quanah	3e	---	150.00	---	25.00	---	15.00	---
Talpa	7s	---	150.00	---	25.00	---	15.00	---
QUG:								
Quinlan	7e	---	---	---	---	---	---	---
Rock outcrop	8s	---	---	---	---	---	---	---
RCG:								
Rock outcrop	8s	---	---	---	---	---	---	---
Cottonwood	7s	---	---	---	---	---	---	---
ShB:								
Shrewder	2e	---	275.00	---	30.00	---	25.00	---
ShC:								
Shrewder	3e	---	175.00	---	20.00	---	15.00	---
SpA:								
St. Paul	2c	---	350.00	---	35.00	---	30.00	---
TaC:								
Talpa	7s	---	---	---	---	---	---	---

Table 6.--Irrigated and Nonirrigated Yields by Map Unit--Continued

Map symbol and soil name	Land capability		Cotton lint		Grain sorghum		Wheat	
	N	I	N	I	N	I	N	I
			Lbs	Lbs	Bu	Bu	Bu	Bu
TKG:								
Talpa	7s	---	---	---	---	---	---	---
Knoco	7s	---	---	---	---	---	---	---
Rock outcrop	8s	---	---	---	---	---	---	---
TQB:								
Talpa	7s	---	---	---	---	---	---	---
Quanah	2e	---	---	---	---	---	---	---
TvB:								
Tilvern	3e	---	---	---	25.00	50.00	16.00	30.00
W:								
Water	---	---	---	---	---	---	---	---
WcA:								
Westill	2s	---	275.00	700.00	28.00	65.00	25.00	45.00
WeA:								
Westola	2w	---	425.00	---	50.00	---	30.00	---
WfA:								
Westola	5w	---	---	---	---	---	---	---
WhA:								
Wheatwood	5w	---	---	---	---	---	---	---
WoC:								
Woodward	3e	---	250.00	---	25.00	---	15.00	---
WoD:								
Woodward	4e	---	200.00	---	20.00	---	15.00	---
WQF:								
Woodward	6e	---	---	---	---	---	---	---
Quinlan	6e	---	---	---	---	---	---	---
WQG:								
Woodward	6e	---	---	---	---	---	---	---
Quinlan	6e	---	---	---	---	---	---	---
Rough broken land	7e	---	---	---	---	---	---	---
YmA:								
Yomont	3e	---	350.00	1,000.00	40.00	100.00	25.00	60.00
YtA:								
Yomont	5w	---	---	---	---	---	---	---

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:					
Acme	85	Somewhat limited		Somewhat limited	
		Sodium content	0.02	Sodium content	0.02
AsC:					
Aspermont	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Shallow to densic materials	1.00
		Shallow to densic materials	1.00	Droughty	0.99
		Droughty	0.99	Slope	0.63
BmA:					
Beckman	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Flooding	1.00	Flooding	1.00
		Salinity	0.50	Sodium content	0.08
		Runoff	0.40	Salinity	0.01
		Sodium content	0.08		
CaA:					
Carey	90	Somewhat limited		Very limited	
		Slow water movement	0.50	Low adsorption	1.00
				Slow water movement	0.37
CKF:					
Cottonwood	55	Very limited		Very limited	
		Depth to bedrock	1.00	Droughty	1.00
		Droughty	1.00	Depth to bedrock	1.00
		Slope	0.63	Low adsorption	1.00
				Slope	0.63
Knoco	30	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Shallow to densic materials	1.00
		Shallow to densic materials	1.00	Droughty	0.90
		Droughty	0.90	Slope	0.63

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
DeC:					
Delwin	90	Very limited		Very limited	
		Filtering capacity	0.99	Filtering capacity	0.99
DvD:					
Devol	85	Not limited		Not limited	
EnB:					
Enterprise	85	Not limited		Not limited	
EnC:					
Enterprise	85	Not limited		Not limited	
FoA:					
Foursixes	80	Very limited		Very limited	
		Slow water movement	1.00	Low adsorption	1.00
		Depth to bedrock	0.95	Slow water movement	1.00
		Droughty	0.87	Depth to bedrock	0.95
				Droughty	0.87
FrB:					
Frankirk	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
GdB:					
Grandfield	90	Not limited		Not limited	
GdC2:					
Grandfield, moderately eroded	85	Not limited		Not limited	
GfB:					
Grandfield	85	Not limited		Not limited	
GfC:					
Grandfield	92	Not limited		Not limited	
HaC:					
Hardeman	85	Not limited		Not limited	
JaC:					
Jaywi	80	Not limited		Not limited	
JeE:					
Jester	90	Very limited		Very limited	
		Filtering capacity	0.99	Filtering capacity	0.99
		Droughty	0.70	Droughty	0.70
		Leaching	0.45		
KgA:					
Kingco	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40		

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
KVD:					
Knoco	35	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Shallow to densic materials	1.00
		Shallow to densic materials	1.00	Droughty	0.92
		Droughty	0.92		
Vernon	25	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	0.54	Depth to bedrock	0.54
		Shallow to densic materials	0.54	Shallow to densic materials	0.54
		Runoff	0.40	Droughty	0.22
		Droughty	0.22		
LaA:					
Lazare	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Runoff	0.40		
LnA:					
Lincoln	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	0.99	Filtering capacity	0.99
		Droughty	0.62	Droughty	0.62
		Leaching	0.45		
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Not limited		Not limited	
NoC:					
Nobscot	80	Somewhat limited		Not limited	
		Leaching	0.45		
NpB:					
Nipsum	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ObC:					
Obaro	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Low adsorption	1.00
		Droughty	0.01	Slow water movement	0.37
		Depth to bedrock	0.01	Droughty	0.01
		Shallow to densic materials	0.01	Depth to bedrock	0.01
				Shallow to densic materials	0.01
PdB:					
Paducah	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
QnB:					
Quanah	85	Not limited		Not limited	
QTD:					
Quanah	54	Not limited		Not limited	
Talpa	36	Very limited		Very limited	
		Depth to bedrock	1.00	Droughty	1.00
		Droughty	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Runoff	0.40		
QUG:					
Quinlan	56	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Shallow to densic materials	1.00	Shallow to densic materials	1.00
		Droughty	1.00	Droughty	1.00
		Slope	1.00	Slope	1.00
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Very limited		Very limited	
		Slope	1.00	Droughty	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Droughty	1.00	Low adsorption	1.00
				Slope	1.00
ShB:					
Shrewder	90	Somewhat limited		Very limited	
		Slow water movement	0.54	Low adsorption	1.00
				Slow water movement	0.40

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ShC:					
Shrewder	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Low adsorption	1.00
				Slow water movement	0.37
SpA:					
St. Paul	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
TaC:					
Talpa	80	Very limited		Very limited	
		Depth to bedrock	1.00	Droughty	1.00
		Droughty	1.00	Depth to bedrock	1.00
		Runoff	0.40	Low adsorption	1.00
TKG:					
Talpa	63	Very limited		Very limited	
		Depth to bedrock	1.00	Droughty	1.00
		Droughty	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Slope	1.00	Slope	1.00
		Runoff	0.40		
Knoco	24	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Shallow to densic materials	1.00
		Shallow to densic materials	1.00	Slope	1.00
		Large stones content	1.00	Droughty	0.97
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Very limited		Very limited	
		Depth to bedrock	1.00	Droughty	1.00
		Droughty	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Runoff	0.40		
Quanah	30	Not limited		Not limited	
TvB:					
Tilvern	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40	Sodium content	0.32
		Sodium content	0.32		
		Salinity	0.01		
W:					
Water	100	Not rated		Not rated	

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WcA:					
Westill	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40		
WeA:					
Westola	85	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
WfA:					
Westola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
WhA:					
Wheatwood	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
WoC:					
Woodward	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Low adsorption	1.00
		Depth to bedrock	0.01	Slow water movement	0.37
		Shallow to densic materials	0.01	Depth to bedrock	0.01
				Shallow to densic materials	0.01
WoD:					
Woodward	80	Somewhat limited		Very limited	
		Slow water movement	0.50	Low adsorption	1.00
		Depth to bedrock	0.16	Slow water movement	0.37
		Shallow to densic materials	0.15	Depth to bedrock	0.16
				Shallow to densic materials	0.15
WQF:					
Woodward	69	Somewhat limited		Very limited	
		Depth to bedrock	0.65	Low adsorption	1.00
		Shallow to densic materials	0.64	Depth to bedrock	0.65
		Slow water movement	0.50	Shallow to densic materials	0.64
		Slope	0.16	Slow water movement	0.37
		Droughty	0.06	Slope	0.16
Quinlan	23	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Shallow to densic materials	1.00	Shallow to densic materials	1.00
		Droughty	0.99	Droughty	0.99
		Slow water movement	0.50	Slow water movement	0.37

Table 7.--Agricultural Disposal of Manure, Food-Processing Waste, and Sewage Sludge--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WQG:					
Woodward	34	Very limited		Very limited	
		Slope	1.00	Low adsorption	1.00
		Depth to bedrock	0.54	Slope	1.00
		Shallow to densic materials	0.54	Depth to bedrock	0.54
		Slow water movement	0.50	Shallow to densic materials	0.54
		Droughty	0.02	Slow water movement	0.37
Quinlan	29	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dense layer	1.00	Low adsorption	1.00
		Shallow to densic materials	1.00	Shallow to densic materials	1.00
		Droughty	1.00	Droughty	1.00
		Slope	1.00	Slope	1.00
Rough broken land	19	Not rated		Not rated	
YmA:					
Yomont	90	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
YtA:					
Yomont	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:					
Acme	85	Somewhat limited		Very limited	
		Sodium content	0.02	Seepage	1.00
				Too level	0.50
				Sodium content	0.02
AsC:					
Aspermont	85	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
		Too steep for surface application	0.02	Depth to bedrock	0.84
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Too steep for surface application	1.00		
		Droughty	0.99		
		Too steep for sprinkler application	0.78		
BmA:					
Beckman	90	Very limited		Very limited	
		Slow water movement	1.00	Flooding	1.00
		Flooding	1.00	Too level	0.50
		Sodium content	0.08	Sodium content	0.08
		Salinity	0.01		
CaA:					
Carey	90	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
				Too level	0.50
CKF:					
Cottonwood	55	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00
		Too steep for surface application	1.00	Too steep for surface application	1.00
		Too steep for sprinkler application	0.78		

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Knoco----------------	30	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Too steep for surface application	1.00		
		Droughty	0.90		
		Too steep for sprinkler application	0.78		
DeC:					
Delwin---------------	90	Very limited		Very limited	
		Filtering capacity	0.99	Seepage	1.00
DvD:					
Devol----------------	85	Somewhat limited		Very limited	
		Too steep for surface application	0.50	Seepage	1.00
EnB:					
Enterprise-----------	85	Not limited		Very limited	
				Seepage	1.00
EnC:					
Enterprise-----------	85	Somewhat limited		Very limited	
		Too steep for surface application	0.08	Seepage	1.00
FoA:					
Foursixes------------	80	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	0.95	Seepage	1.00
		Droughty	0.87	Too level	0.50
FrB:					
Frankirk-------------	90	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
GdB:					
Grandfield-----------	90	Not limited		Very limited	
				Seepage	1.00
GdC2:					
Grandfield, moderately eroded--	85	Somewhat limited		Very limited	
		Too steep for surface application	0.02	Seepage	1.00

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
GfB:					
Grandfield	85	Not limited		Very limited	
				Seepage	1.00
GfC:					
Grandfield	92	Somewhat limited		Very limited	
		Too steep for surface application	0.08	Seepage	1.00
HaC:					
Hardeman	85	Not limited		Very limited	
				Seepage	1.00
JaC:					
Jaywi	80	Somewhat limited		Very limited	
		Too steep for surface application	0.02	Seepage	1.00
JeE:					
Jester	90	Very limited		Very limited	
		Filtering capacity	0.99	Seepage	1.00
		Too steep for surface application	0.98	Too steep for surface application	0.12
		Droughty	0.70		
		Too steep for sprinkler application	0.06		
KgA:					
Kingco	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.62
				Too level	0.50
KVD:					
Knoco	35	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00		
		Droughty	0.92		
		Too steep for surface application	0.68		
Vernon	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	0.54		
		Droughty	0.22		
LaA:					
Lazare	85	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Ponding	1.00	Depth to saturated zone	1.00
		Depth to saturated zone	1.00	Too level	0.92
LnA:					
Lincoln	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	0.99	Seepage	1.00
		Droughty	0.62	Too level	0.50
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Not limited		Very limited	
				Seepage	1.00
				Too level	0.50
NoC:					
Nobscot	80	Not limited		Very limited	
				Seepage	1.00
NpB:					
Nipsum	90	Very limited		Not limited	
		Slow water movement	1.00		
ObC:					
Obaro	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Depth to bedrock	1.00
		Droughty	0.01	Seepage	1.00
		Depth to bedrock	0.01		
PdB:					
Paducah	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
QnB:					
Quanah	85	Not limited		Very limited	
				Seepage	1.00
QTD:					
Quanah	54	Somewhat limited		Very limited	
		Too steep for surface application	0.08	Seepage	1.00
Talpa	36	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00
		Too steep for surface application	0.68		

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
QUG:					
Quinlan	56	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep for surface application	1.00	Seepage	1.00
		Droughty	1.00	Too steep for surface application	1.00
		Too steep for sprinkler application	1.00		
		Slow water movement	0.37		
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	1.00		
ShB:					
Shrewder	90	Somewhat limited		Very limited	
		Slow water movement	0.40	Seepage	1.00
ShC:					
Shrewder	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
		Too steep for surface application	0.08		
SpA:					
St. Paul	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
				Too level	0.50
TaC:					
Talpa	80	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
TKG:					
Talpa	63	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00
		Too steep for surface application	1.00	Too steep for surface application	1.00
		Too steep for sprinkler application	1.00		
Knoco	24	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Too steep for surface application	1.00		
		Too steep for sprinkler application	1.00		
		Droughty	0.97		
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Seepage	1.00
Quanah	30	Not limited		Very limited	
				Seepage	1.00
TvB:					
Tilvern	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Sodium content	0.32
		Sodium content	0.32	Depth to bedrock	0.18
W:					
Water	100	Not rated		Not rated	
WcA:					
Westill	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.62
				Too level	0.50
				Depth to bedrock	0.01
WeA:					
Westola	85	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
				Seepage	1.00
				Too level	0.50

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WfA:					
Westola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
				Seepage	1.00
				Too level	0.50
WhA:					
Wheatwood	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
				Seepage	1.00
				Too level	0.50
WoC:					
Woodward	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Depth to bedrock	1.00
		Too steep for surface application	0.02	Seepage	1.00
		Depth to bedrock	0.01		
WoD:					
Woodward	80	Somewhat limited		Very limited	
		Too steep for surface application	0.82	Depth to bedrock	1.00
		Slow water movement	0.37	Seepage	1.00
		Depth to bedrock	0.16	Too steep for surface application	0.01
		Too steep for sprinkler application	0.01		
WQF:					
Woodward	69	Very limited		Very limited	
		Too steep for surface application	1.00	Depth to bedrock	1.00
		Depth to bedrock	0.65	Seepage	1.00
		Too steep for sprinkler application	0.40	Too steep for surface application	0.78
		Slow water movement	0.37		
		Droughty	0.06		
Quinlan	23	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep for surface application	1.00	Seepage	1.00
		Droughty	0.99	Too steep for surface application	0.78
		Too steep for sprinkler application	0.40		

Table 8.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation		Overland flow of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Slow water movement	0.37		
WQG:					
Woodward	34	Very limited		Very limited	
		Too steep for surface application	1.00	Depth to bedrock	1.00
		Too steep for sprinkler application	1.00	Seepage	1.00
		Depth to bedrock	0.54	Too steep for surface application	1.00
		Slow water movement	0.37		
		Droughty	0.02		
Quinlan	29	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Droughty	1.00	Seepage	1.00
		Too steep for surface application	1.00	Too steep for surface application	1.00
		Too steep for sprinkler application	1.00		
		Slow water movement	0.37		
Rough broken land	19	Not rated		Very limited	
				Seepage	1.00
				Depth to bedrock	1.00
				Too steep for surface application	1.00
YmA:					
Yomont	90	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
				Seepage	1.00
				Too level	0.50
YtA:					
Yomont	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
				Seepage	1.00
				Too level	0.50

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table).

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:					
Acme	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Sodium content	0.02
AsC:					
Aspermont	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	0.84
				Too steep for surface application	0.02
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	1.00
		Slope	1.00	Too steep for surface application	1.00
				Too steep for sprinkler irrigation	1.00
BmA:					
Beckman	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00	Slow water movement	1.00
				Sodium content	0.08
				Salinity	0.01
CaA:					
Carey	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
		Depth to bedrock	1.00		
CKF:					
Cottonwood	55	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Knoco	30	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	1.00
		Slope	1.00	Too steep for surface application	1.00
				Too steep for sprinkler irrigation	1.00
DeC:					
Delwin	90	Very limited		Very limited	
		Slow water movement	1.00	Filtering capacity	0.99
DvD:					
Devol	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.32	Too steep for surface application	0.50
		Slope	0.28		
EnB:					
Enterprise	85	Somewhat limited		Not limited	
		Slow water movement	0.32		
EnC:					
Enterprise	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.32	Too steep for surface application	0.08
FoA:					
Foursixes	80	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	0.94
FrB:					
Frankirk	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
GdB:					
Grandfield	90	Very limited		Not limited	
		Slow water movement	1.00		
GdC2:					
Grandfield, moderately eroded	85	Very limited		Somewhat limited	

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Slow water movement	1.00	Too steep for surface application	0.02
GfB:					
Grandfield----------	85	Very limited		Not limited	
		Slow water movement	1.00		
GfC:					
Grandfield----------	92	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.08
HaC:					
Hardeman------------	85	Somewhat limited		Not limited	
		Slow water movement	0.32		
JaC:					
Jaywi---------------	80	Very limited		Somewhat limited	
		Slow water movement	0.99	Too steep for surface application	0.02
JeE:					
Jester--------------	90	Somewhat limited		Very limited	
		Slope	0.97	Filtering capacity	0.99
				Too steep for surface application	0.98
				Too steep for sprinkler irrigation	0.12
KgA:					
Kingco--------------	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94
KVD:					
Knoco---------------	35	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	1.00
		Slope	0.50	Too steep for surface application	0.68
Vernon--------------	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	1.00

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
LaA:					
Lazare	85	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Depth to saturated zone	1.00	Slow water movement	1.00
LnA:					
Lincoln	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
				Filtering capacity	0.99
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Very limited		Not limited	
		Slow water movement	1.00		
NoC:					
Nobscot	80	Somewhat limited		Not limited	
		Slow water movement	0.32		
NpB:					
Nipsum	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94
ObC:					
Obaro	85	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	0.26
PdB:					
Paducah	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
		Depth to bedrock	1.00		
QnB:					
Quanah	85	Very limited		Not limited	
		Slow water movement	1.00		
QTD:					
Quanah	54	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.08
Talpa	36	Very limited		Very limited	

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Slow water movement	1.00	Too steep for surface application	0.68
		Slope	0.50		
QUG:					
Quinlan	56	Very limited		Very limited	
		Slope	1.00	Depth to bedrock	1.00
		Slow water movement	1.00	Too steep for surface application	1.00
		Depth to bedrock	1.00	Too steep for sprinkler irrigation	1.00
				Slow water movement	0.26
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Very limited		Very limited	
		Slope	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Slow water movement	1.00	Too steep for sprinkler irrigation	1.00
ShB:					
Shrewder	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.28
		Depth to bedrock	1.00		
ShC:					
Shrewder	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
		Depth to bedrock	1.00	Too steep for surface application	0.08
SpA:					
St. Paul	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
TaC:					
Talpa	80	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slow water movement	1.00		
TKG:					
Talpa	63	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
Knoco	24	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	1.00
		Slope	1.00	Too steep for surface application	1.00
				Too steep for sprinkler irrigation	1.00
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slow water movement	1.00		
Quanah	30	Very limited		Not limited	
		Slow water movement	1.00		
TvB:					
Tilvern	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Sodium content	0.32
				Depth to bedrock	0.18
W:					
Water	100	Not rated		Not rated	
WcA:					
Westill	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Depth to bedrock	1.00	Depth to bedrock	0.01
WeA:					
Westola	85	Somewhat limited		Somewhat limited	
		Flooding	0.60	Flooding	0.60
		Slow water movement	0.32		
WfA:					
Westola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.32		

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WhA:					
Wheatwood	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
WoC:					
Woodward	85	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Slow water movement	0.26
				Too steep for surface application	0.02
WoD:					
Woodward	80	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	0.82
		Slope	0.72	Slow water movement	0.26
				Too steep for sprinkler irrigation	0.01
WQF:					
Woodward	69	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	0.78
				Slow water movement	0.26
Quinlan	23	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	0.78
				Slow water movement	0.26
WQG:					
Woodward	34	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00

Table 9.--Agricultural Disposal of Wastewater by Rapid Infiltration and Slow Rate Treatment--Continued

Map symbol and soil name	Pct. of map unit	Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
				Slow water movement	0.26
Quinlan	29	Very limited		Very limited	
		Slow water movement	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
				Slow water movement	0.26
Rough broken land	19	Not rated		Not rated	
YmA:					
Yomont	90	Somewhat limited		Somewhat limited	
		Flooding	0.60	Flooding	0.60
		Slow water movement	0.32		
YtA:					
Yomont	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.32		

Table 10.--Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are rated.)

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
AcA:				
Acme	Loamy Pe 25-36	2,500	1,800	1,300
AsC:				
Aspermont	Loamy Pe 25-36	3,500	2,800	2,000
BKF:				
Badland	---	---	---	---
Knoco	Very Shallow Clay Pe 25-36	1,500	1,000	600
BmA:				
Beckman	Saline Bottomland Pe 25-36	4,000	3,000	2,000
CaA:				
Carey	Loamy Prairie Pe 25-36	2,600	2,100	1,600
CKF:				
Cottonwood	Gyp Pe 25-36	1,800	1,100	400
Knoco	Very Shallow Clay Pe 25-36	1,500	1,000	600
DeC:				
Delwin	Sandy Pe 25-36	3,600	2,700	1,800
DvD:				
Devol	Loamy Sand Prairie Pe 25-36	4,000	3,000	2,000
EnB:				
Enterprise	Sandy Loam Pe 25-36	3,000	2,400	1,700
EnC:				
Enterprise	Sandy Loam Pe 25-36	3,000	2,400	1,700
FoA:				
Foursixes	Clay Loam Pe 25-36	2,000	1,500	1,000
FrB:				
Frankirk	Loamy Prairie Pe 25-36	2,500	2,000	1,500
GdB:				
Grandfield	Loamy Sand Prairie Pe 25-36	4,000	3,000	2,000
GdC2:				
Grandfield, moderately eroded	Loamy Sand Prairie Pe 25-36	2,800	2,000	1,500
GfB:				
Grandfield	Sandy Loam Pe 25-36	3,000	2,400	1,700
GfC:				
Grandfield	Sandy Loam Pe 25-36	3,000	2,400	1,700
HaC:				
Hardeman	Sandy Loam Pe 25-36	3,000	2,400	1,800
JaC:				
Jaywi	Loamy Pe 25-36	3,500	2,800	2,000
JeE:				
Jester	Sand Hills Pe 25-36	3,000	2,100	1,300

Table 10.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
KgA:				
Kingco	Clay Loam Pe 25-36	2,200	1,600	1,000
KVD:				
Knoco	Very Shallow Clay Pe 25-36	1,500	1,000	600
Vernon	Shallow Clay Pe 25-36	2,000	1,500	1,000
LaA:				
Lazare	Lakebed Pe 25-36	4,000	2,500	500
LnA:				
Lincoln	Sandy Bottomland Pe 25-36	3,000	2,300	1,800
M-W:				
Water, miscellaneous	---	---	---	---
MfA:				
Miles	Sandy Loam Pe 25-36	2,800	2,250	1,800
NoC:				
Nobscot	Sandy Pe 25-36	3,900	2,800	2,000
NpB:				
Nipsum	Clay Loam Pe 25-36	2,200	1,700	1,200
ObC:				
Obaro	Loamy Prairie Pe 25-36	2,600	2,100	1,600
PdB:				
Paducah	Loamy Prairie Pe 25-36	2,500	2,000	1,500
QnB:				
Quanah	Loamy Pe 25-36	3,500	2,800	2,000
QTD:				
Quanah	Loamy Pe 25-36	3,500	2,800	2,000
Talpa	Very Shallow Pe 25-36	1,500	1,000	500
QUG:				
Quinlan	Loamy Prairie Pe 25-36	2,500	1,800	1,300
Rock outcrop	---	---	---	---
RCG:				
Rock outcrop	---	---	---	---
Cottonwood	Gyp Pe 25-36	1,800	1,100	400
ShB:				
Shrewder	Sandy Loam Pe 25-36	3,000	2,400	1,700
ShC:				
Shrewder	Sandy Loam Pe 25-36	3,000	2,400	1,700
SpA:				
St. Paul	Clay Loam Pe 25-36	2,000	1,500	1,000
TaC:				
Talpa	Very Shallow Pe 25-36	1,500	1,000	500

Table 10.--Rangeland Productivity--Continued

Map symbol and soil name	Ecological site	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
TKG:				
Talpa	Very Shallow Pe 25-36	1,500	1,000	500
Knoco	Rocky Hill Pe 25-36	1,500	1,000	600
Rock outcrop	---	---	---	---
TQB:				
Talpa	Very Shallow Pe 25-36	1,500	1,000	500
Quanah	Loamy Pe 25-36	3,500	2,800	2,000
TvB:				
Tilvern	Shallow Clay Pe 25-36	2,200	1,700	1,200
W:				
Water	---	---	---	---
WcA:				
Westill	Clay Loam Pe 25-36	2,000	1,500	1,000
WeA:				
Westola	Loamy Bottomland Pe 25-36	4,800	3,000	1,800
WfA:				
Westola	Loamy Bottomland Pe 25-36	4,800	3,000	1,800
WhA:				
Wheatwood	Loamy Bottomland Pe 25-36	6,000	4,000	2,000
WoC:				
Woodward	Loamy Prairie Pe 25-36	2,600	2,100	1,600
WoD:				
Woodward	Loamy Prairie Pe 25-36	2,600	2,100	1,600
WQF:				
Woodward	Loamy Prairie Pe 25-36	2,600	2,100	1,600
Quinlan	Loamy Prairie Pe 25-36	4,000	3,300	2,500
WQG:				
Woodward	Loamy Prairie Pe 25-36	2,600	2,100	1,600
Quinlan	Loamy Prairie Pe 25-36	4,000	3,300	2,500
Rough broken land	Rough Breaks Pe 25-36	1,200	900	600
YmA:				
Yomont	Loamy Bottomland Pe 25-36	6,000	4,000	2,000
YtA:				
Yomont	Loamy Bottomland Pe 25-36	6,000	4,000	2,000

Table 11.--Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height.)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AcA:					
Acme	common lilac; skunkbush sumac	American plum; Amur honeysuckle	black locust; eastern redcedar; honeylocust; oneseed juniper; osageorange; red mulberry; redbud; Scotch pine; Siberian elm	---	---
AsC:					
Aspermont	common lilac; skunkbush sumac	American plum; Amur honeysuckle; winterberry euonymus	desert willow; eastern redcedar; oriental arborvitae; osageorange; Russian olive	black locust; honeylocust; Siberian elm	---
BKF:					
Badland	---	---	---	---	---
Knoco	---	---	---	---	---
BmA:					
Beckman	---	---	eastern redcedar	---	---
CaA:					
Carey	common lilac; skunkbush sumac	American plum; Amur honeysuckle	Austrian pine; desert willow; eastern redcedar; oriental arborvitae; osageorange; Russian olive	black locust; honeylocust; lacebark elm; red mulberry; Siberian elm	---
CKF:					
Cottonwood	---	---	---	---	---
Knoco	---	---	---	---	---

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
DeC: Delwin	skunkbush sumac	American plum; Amur honeysuckle; common lilac	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; Rocky Mountain juniper; Russian olive	Austrian pine; black locust; honeylocust; ponderosa pine; red mulberry	Siberian elm
DvD: Devol	common lilac; skunkbush sumac	American plum; Amur honeysuckle	Austrian pine; eastern redcedar; osageorange; red mulberry; redbud	black locust; honeylocust; Siberian elm; silver maple	---
EnB: Enterprise	skunkbush sumac	American plum; Amur honeysuckle; desert willow	Arizona cypress; Austrian pine; eastern redcedar; oriental arborvitae; osageorange; Russian olive	cypress; green ash; honeylocust; lacebark elm; ponderosa pine; red mulberry	Siberian elm
EnC: Enterprise	skunkbush sumac	American plum; Amur honeysuckle; desert willow	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; Russian olive	honeylocust; lacebark elm; ponderosa pine; red mulberry	Siberian elm
FoA: Foursixes	skunkbush sumac	---	---	---	---
FrB: Frankirk	Amur honeysuckle; skunkbush sumac	American plum; common lilac; redbud	Arizona cypress; honeylocust; osageorange; Russian olive	hackberry; lacebark elm; red mulberry	---

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
GdB: Grandfield	skunkbush sumac	American plum; Amur honeysuckle; common lilac	desert willow; redbud; Rocky Mountain juniper	Austrian pine; black locust; eastern redcedar; honeylocust; osageorange; Siberian elm; silver maple	ponderosa pine
GdC2: Grandfield, moderately eroded	skunkbush sumac	American plum; Amur honeysuckle; common lilac	desert willow; redbud; Rocky Mountain juniper	Austrian pine; black locust; eastern redcedar; honeylocust; osageorange; Siberian elm; silver maple	ponderosa pine
GfB: Grandfield	skunkbush sumac	American plum; Amur honeysuckle; common lilac	desert willow; red mulberry; redbud; Rocky Mountain juniper	Austrian pine; black locust; eastern redcedar; honeylocust; osageorange; Siberian elm; silver maple	---
GfC: Grandfield	skunkbush sumac	American plum; Amur honeysuckle; common lilac	desert willow; red mulberry; redbud; Rocky Mountain juniper	Austrian pine; black locust; eastern redcedar; honeylocust; osageorange; Siberian elm; silver maple	---
HaC: Hardeman	skunkbush sumac	American plum; Amur honeysuckle; common lilac	Arizona cypress; desert willow; eastern redcedar; green ash; oriental	Austrian pine; black locust; honeylocust	ponderosa pine; Siberian elm

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
			arborvitae; osageorange; red mulberry; Russian olive; Scotch pine		
JaC:					
Jaywi	skunkbush sumac	American plum; Amur honeysuckle; winterberry euonymus	eastern redcedar; oriental arborvitae; osageorange; Russian olive	honeylocust; red mulberry	Siberian elm
JeE:					
Jester	skunkbush sumac	American plum; Amur honeysuckle; Austrian pine; common lilac	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; Russian olive; western soapberry	honeylocust; osageorange	American sycamore; eastern cottonwood; Siberian elm
KgA:					
Kingco	fourwing saltbush; skunkbush sumac	Austrian pine; eastern redcedar; oriental arborvitae	honeylocust; osageorange; red mulberry; Russian olive; Siberian elm	---	---
KVD:					
Knoco	---	---	---	---	---
Vernon	fourwing saltbush; skunkbush sumac	eastern redcedar; osageorange	---	---	---
LaA:					
Lazare	---	---	---	---	---
LnA:					
Lincoln	skunkbush sumac	Amur honeysuckle; common lilac	American plum; Austrian pine; redbud	eastern redcedar; honeylocust; Siberian elm	American sycamore; black locust; eastern cottonwood

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
M-W: Water, miscellaneous	---	---	---	---	---
MfA: Miles	skunkbush sumac	American plum; Amur honeysuckle	Arizona cypress; desert willow; eastern redcedar; green ash; oriental arborvitae; red mulberry; Rocky Mountain juniper; Russian olive	black locust; hackberry; honeylocust; lacebark elm; osageorange	Siberian elm
NoC: Nobscot	Amur honeysuckle; common lilac; skunkbush sumac	American plum; desert willow; oriental arborvitae; Rocky Mountain juniper	Austrian pine; eastern redcedar; osageorange; ponderosa pine; red mulberry; Scotch pine	black locust; Siberian elm	---
NpB: Nipsum	skunkbush sumac	Amur honeysuckle	eastern redcedar; lacebark elm; osageorange; Russian olive	Afghan pine; hackberry; Siberian elm	---
ObC: Obaro	common lilac; skunkbush sumac	American plum; desert willow; winterberry euonymus	eastern redcedar; oriental arborvitae; osageorange; Rocky Mountain juniper; Russian olive	black locust; Siberian elm	---
PdB: Paducah	common lilac; skunkbush sumac	American plum; Amur honeysuckle	Arizona cypress; eastern redcedar; green ash; oriental arborvitae;	black locust; honeylocust	Siberian elm

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
			osageorange; Russian olive; western soapberry		
QnB:					
Quanah	fourwing saltbush; skunkbush sumac	American plum; Amur honeysuckle; Russian olive	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; western soapberry	black locust; honeylocust; Siberian elm	---
QTD:					
Quanah	fourwing saltbush; skunkbush sumac	American plum; Amur honeysuckle; Russian olive	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; western soapberry	black locust; honeylocust; Siberian elm	---
Talpa	---	---	---	---	---
QUG:					
Quinlan	Amur honeysuckle; common lilac; skunkbush sumac	redbud	eastern redcedar; oriental arborvitae; osageorange; Rocky Mountain juniper	---	---
Rock outcrop	---	---	---	---	---
RCG:					
Rock outcrop	---	---	---	---	---
Cottonwood	---	---	---	---	---
ShB:					
Shrewder	skunkbush sumac	common lilac	American plum; Amur honeysuckle; desert willow	Austrian pine; black locust; eastern redcedar;	eastern cottonwood; Scotch pine

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
				honeylocust; ponderosa pine; Siberian elm	
ShC:					
Shrewder	skunkbush sumac	common lilac	American plum; Amur honeysuckle; desert willow	Austrian pine; black locust; eastern redcedar; honeylocust; ponderosa pine; Siberian elm	eastern cottonwood; Scotch pine
SpA:					
St. Paul	common lilac; fourwing saltbush	American plum; Amur honeysuckle	autumn olive; bur oak; Russian olive	ponderosa pine; red mulberry; Scotch pine; Siberian elm	American sycamore
TaC:					
Talpa	---	---	---	---	---
TKG:					
Talpa	---	---	---	---	---
Knoco	---	---	---	---	---
Rock outcrop	---	---	---	---	---
TQB:					
Talpa	---	---	---	---	---
Quanah	fourwing saltbush; skunkbush sumac	American plum; Amur honeysuckle; Russian olive	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange	black locust; honeylocust; Siberian elm	---
TvB:					
Tilvern	fourwing saltbush; skunkbush sumac	eastern redcedar	desert willow; osageorange	black locust; oneseed juniper	---
W:					
Water	---	---	---	---	---

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WcA:					
Westill	fourwing saltbush; skunkbush sumac	oriental arborvitae	eastern redcedar; honeylocust; osageorange	Siberian elm	oneseed juniper
WeA:					
Westola	skunkbush sumac	American plum; common lilac	Arizona cypress; desert willow; red mulberry	Austrian pine; eastern redcedar; osageorange; ponderosa pine; Scotch pine	American sycamore; eastern cottonwood; Siberian elm
WfA:					
Westola	skunkbush sumac	American plum; common lilac	Arizona cypress; desert willow; red mulberry	Austrian pine; eastern redcedar; osageorange; ponderosa pine; Scotch pine	American sycamore; eastern cottonwood; Siberian elm
WhA:					
Wheatwood	Amur honeysuckle; common lilac; skunkbush sumac	American plum	desert willow; oriental arborvitae; Rocky Mountain juniper	Austrian pine; black locust; eastern redcedar; ponderosa pine; red mulberry	American sycamore; eastern cottonwood; green ash; loblolly pine
WoC:					
Woodward	skunkbush sumac	common lilac	American plum; Amur honeysuckle; redbud	Austrian pine; common hackberry; eastern redcedar; osageorange	honeylocust; Siberian elm; silver maple
WoD:					
Woodward	skunkbush sumac	common lilac	American plum; Amur honeysuckle; redbud	Austrian pine; common hackberry; eastern redcedar; osageorange	honeylocust; Siberian elm; silver maple
WQF:					
Woodward	skunkbush sumac	common lilac	American plum; Amur honeysuckle; redbud	Austrian pine; common hackberry;	honeylocust; Siberian elm;

Table 11.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
				eastern redcedar; osageorange	silver maple
Quinlan-----------------	Amur honeysuckle; common lilac; skunkbush sumac	redbud	eastern redcedar; oriental arborvitae; osageorange; Rocky Mountain juniper	---	---
WQG:					
Woodward----------------	skunkbush sumac	common lilac	American plum; Amur honeysuckle; redbud	Austrian pine; common hackberry; eastern redcedar; osageorange	honeylocust; Siberian elm; silver maple
Quinlan-----------------	Amur honeysuckle; common lilac; skunkbush sumac	redbud	eastern redcedar; oriental arborvitae; osageorange; Rocky Mountain juniper	---	---
Rough broken land-------	---	---	---	---	---
YmA:					
Yomont------------------	Amur honeysuckle; common lilac; skunkbush sumac	American plum; Russian olive	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; Rocky Mountain juniper	Austrian pine; honeylocust; red mulberry; Siberian elm	American sycamore; eastern cottonwood
YtA:					
Yomont------------------	Amur honeysuckle; common lilac; skunkbush sumac	American plum; Russian olive	Arizona cypress; eastern redcedar; green ash; oriental arborvitae; osageorange; Rocky Mountain juniper	Austrian pine; honeylocust; red mulberry; Siberian elm	American sycamore; eastern cottonwood

Table 12.--Camp Areas, Picnic Areas, and Playgrounds

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Not limited		Not limited		Not limited	
AsC:							
Aspermont	85	Not limited		Not limited		Somewhat limited	
						Slope	0.28
BKF:							
Badland	59	Not rated		Not rated		Not rated	
Knoco	25	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.63	Slope	0.63	Slope	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
BmA:							
Beckman	90	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Too clayey	0.50	Flooding	1.00
		Too clayey	0.50	Slow water movement	0.45	Too clayey	0.50
		Slow water movement	0.45	Flooding	0.40	Slow water movement	0.45
		Salinity	0.01	Salinity	0.01	Salinity	0.01
CaA:							
Carey	90	Not limited		Not limited		Not limited	
CKF:							
Cottonwood	55	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.63	Slope	0.63	Slope	1.00
Knoco	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.63	Slope	0.63	Slope	1.00
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
DeC:							
Delwin	90	Very limited		Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00	Too sandy	1.00
						Slope	0.12
DvD:							
Devol	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.42	Too sandy	0.42	Slope	0.97
						Too sandy	0.42
EnB:							
Enterprise	85	Not limited		Not limited		Not limited	
EnC:							
Enterprise	85	Not limited		Not limited		Somewhat limited	
						Slope	0.50

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FoA: Foursixes	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
FrB: Frankirk	90	Not limited		Not limited		Not limited	
GdB: Grandfield	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.79	Too sandy	0.79	Too sandy	0.79
GdC2: Grandfield, moderately eroded	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.79	Too sandy	0.79	Too sandy	0.79
						Slope	0.28
GfB: Grandfield	85	Not limited		Not limited		Not limited	
GfC: Grandfield	92	Not limited		Not limited		Somewhat limited	
						Slope	0.50
HaC: Hardeman	85	Not limited		Not limited		Somewhat limited	
						Slope	0.12
JaC: Jaywi	80	Not limited		Not limited		Somewhat limited	
						Slope	0.28
JeE: Jester	90	Somewhat limited		Somewhat limited		Very limited	
		Too sandy	0.91	Too sandy	0.91	Slope	1.00
						Too sandy	0.91
KgA: Kingco	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
KVD: Knoco	35	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	0.50	Too clayey	0.50	Slope	1.00
		Slow water movement	0.45	Slow water movement	0.45	Too clayey	0.50
						Slow water movement	0.45
Vernon	25	Very limited		Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00	Sodium content	1.00
		Slow water movement	0.45	Slow water movement	0.45	Depth to bedrock	0.54
						Slow water movement	0.45
						Slope	0.12

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LaA:							
Lazare	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Ponding	1.00	Depth to saturated zone	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Ponding	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
LnA:							
Lincoln	90	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Too sandy	0.91	Flooding	1.00
		Too sandy	0.91	Flooding	0.40	Too sandy	0.91
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles	85	Not limited		Not limited		Not limited	
NoC:							
Nobscot	80	Very limited		Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00	Too sandy	1.00
						Slope	0.12
NpB:							
Nipsum	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
ObC:							
Obaro	85	Not limited		Not limited		Somewhat limited	
						Slope	0.03
						Depth to bedrock	0.01
PdB:							
Paducah	85	Not limited		Not limited		Not limited	
QnB:							
Quanah	85	Not limited		Not limited		Not limited	
QTD:							
Quanah	54	Not limited		Not limited		Somewhat limited	
						Slope	0.50
Talpa	36	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
						Slope	1.00
						Gravel content	0.99
QUG:							
Quinlan	56	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to bedrock	1.00
Rock outcrop	19	Not rated		Not rated		Not rated	

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RCG:							
Rock outcrop	47	Not rated		Not rated		Not rated	
Cottonwood	39	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
ShB:							
Shrewder	90	Not limited		Not limited		Not limited	
ShC:							
Shrewder	85	Not limited		Not limited		Somewhat limited	
						Slope	0.50
SpA:							
St. Paul	85	Not limited		Not limited		Not limited	
TaC:							
Talpa	80	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
						Gravel content	0.90
						Slope	0.12
TKG:							
Talpa	63	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
						Gravel content	0.87
Knoco	24	Very limited		Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00	Large stones content	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
Rock outcrop	7	Not rated		Not rated		Not rated	
TQB:							
Talpa	41	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
						Gravel content	0.90
Quanah	30	Not limited		Not limited		Not limited	
TvB:							
Tilvern	85	Very limited		Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00	Sodium content	1.00
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
WeA:							
Westola--------------	85	Very limited		Not limited		Somewhat limited	
		Flooding	1.00			Flooding	0.60
WfA:							
Westola--------------	85	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.40	Flooding	1.00
WhA:							
Wheatwood-----------	90	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.40	Flooding	1.00
WoC:							
Woodward------------	85	Not limited		Not limited		Somewhat limited	
						Slope	0.28
						Depth to bedrock	0.01
WoD:							
Woodward------------	80	Not limited		Not limited		Very limited	
						Slope	1.00
						Depth to bedrock	0.16
WQF:							
Woodward------------	69	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Slope	0.16	Slope	1.00
						Depth to bedrock	0.65
Quinlan-------------	23	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.16	Slope	0.16	Slope	1.00
WQG:							
Woodward------------	34	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
						Depth to bedrock	0.54
Quinlan-------------	29	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
Rough broken land---	19	Not rated		Not rated		Not rated	
YmA:							
Yomont--------------	90	Very limited		Not limited		Somewhat limited	
		Flooding	1.00			Flooding	0.60
YtA:							
Yomont--------------	80	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.40	Flooding	1.00

Table 13.--Paths, Trails, and Golf Course Fairways

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf course fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Not limited		Not limited		Not limited	
AsC:							
Aspermont	85	Not limited		Not limited		Not limited	
BKF:							
Badland	59	Not rated		Not rated		Not rated	
Knoco	25	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Depth to bedrock	1.00
						Too clayey	1.00
						Droughty	0.93
						Slope	0.63
BmA:							
Beckman	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Flooding	1.00
		Flooding	0.40	Flooding	0.40	Too clayey	1.00
						Salinity	0.01
CaA:							
Carey	90	Not limited		Not limited		Not limited	
CKF:							
Cottonwood	55	Not limited		Not limited		Very limited	
						Depth to bedrock	1.00
						Droughty	1.00
						Slope	0.63
Knoco	30	Very limited		Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00	Depth to bedrock	1.00
						Droughty	0.64
						Slope	0.63
DeC:							
Delwin	90	Very limited		Very limited		Somewhat limited	
		Too sandy	1.00	Too sandy	1.00	Too sandy	0.50
						Droughty	0.01
DvD:							
Devol	85	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.42	Too sandy	0.42		
EnB:							
Enterprise	85	Not limited		Not limited		Not limited	
EnC:							
Enterprise	85	Not limited		Not limited		Not limited	
FoA:							
Foursixes	80	Not limited		Not limited		Somewhat limited	
						Depth to bedrock	0.95
						Droughty	0.03

Table 13.--Paths, Trails, and Golf Course Fairways--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf course fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FrB:							
Frankirk------------	90	Not limited		Not limited		Not limited	
GdB:							
Grandfield----------	90	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.79	Too sandy	0.79		
GdC2:							
Grandfield, moderately eroded--	85	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.79	Too sandy	0.79		
GfB:							
Grandfield----------	85	Not limited		Not limited		Not limited	
GfC:							
Grandfield----------	92	Not limited		Not limited		Not limited	
HaC:							
Hardeman------------	85	Not limited		Not limited		Not limited	
JaC:							
Jaywi---------------	80	Not limited		Not limited		Not limited	
JeE:							
Jester--------------	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.91	Too sandy	0.91	Droughty	0.99
KgA:							
Kingco--------------	85	Not limited		Not limited		Not limited	
KVD:							
Knoco---------------	35	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Depth to bedrock	1.00
						Too clayey	1.00
						Droughty	0.71
Vernon--------------	25	Not limited		Not limited		Very limited	
						Sodium content	1.00
						Depth to bedrock	0.54
						Droughty	0.22
LaA:							
Lazare--------------	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Ponding	1.00
		Ponding	1.00	Ponding	1.00	Depth to saturated zone	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	1.00
LnA:							
Lincoln-------------	90	Somewhat limited		Somewhat limited		Very limited	
		Too sandy	0.91	Too sandy	0.91	Flooding	1.00
		Flooding	0.40	Flooding	0.40	Droughty	0.97
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles---------------	85	Not limited		Not limited		Not limited	

Table 13.--Paths, Trails, and Golf Course Fairways--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf course fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NoC:							
Nobscot	80	Very limited		Very limited		Somewhat limited	
		Too sandy	1.00	Too sandy	1.00	Too sandy	0.50
						Droughty	0.18
NpB:							
Nipsum	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Too clayey	1.00
ObC:							
Obaro	85	Not limited		Not limited		Somewhat limited	
						Depth to bedrock	0.01
PdB:							
Paducah	85	Not limited		Not limited		Not limited	
QnB:							
Quanah	85	Not limited		Not limited		Not limited	
QTD:							
Quanah	54	Not limited		Not limited		Not limited	
Talpa	36	Not limited		Not limited		Very limited	
						Depth to bedrock	1.00
						Droughty	1.00
QUG:							
Quinlan	56	Very limited		Very limited		Very limited	
		Slope	1.00	Water erosion	1.00	Depth to bedrock	1.00
		Water erosion	1.00	Slope	0.14	Slope	1.00
						Droughty	0.79
Rock outcrop	19	Not rated		Not rated		Not rated	
RCG:							
Rock outcrop	47	Not rated		Not rated		Not rated	
Cottonwood	39	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Slope	0.56	Depth to bedrock	1.00
						Slope	1.00
						Droughty	1.00
ShB:							
Shrewder	90	Not limited		Not limited		Not limited	
ShC:							
Shrewder	85	Not limited		Not limited		Not limited	
SpA:							
St. Paul	85	Not limited		Not limited		Not limited	
TaC:							
Talpa	80	Not limited		Not limited		Very limited	
						Depth to bedrock	1.00
						Droughty	1.00

Table 13.--Paths, Trails, and Golf Course Fairways--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf course fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TKG:							
Talpa	63	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Slope	0.04	Depth to bedrock	1.00
						Droughty	1.00
						Slope	1.00
Knoco	24	Very limited		Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00	Depth to bedrock	1.00
		Slope	1.00	Too clayey	0.50	Too clayey	1.00
		Too clayey	0.50	Slope	0.04	Slope	1.00
						Droughty	0.86
						Large stones content	0.16
Rock outcrop	7	Not rated		Not rated		Not rated	
TQB:							
Talpa	41	Not limited		Not limited		Very limited	
						Depth to bedrock	1.00
						Droughty	1.00
Quanah	30	Not limited		Not limited		Not limited	
TvB:							
Tilvern	85	Not limited		Not limited		Very limited	
						Sodium content	1.00
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Not limited		Not limited		Not limited	
WeA:							
Westola	85	Not limited		Not limited		Somewhat limited	
						Flooding	0.60
WfA:							
Westola	85	Somewhat limited		Somewhat limited		Very limited	
		Flooding	0.40	Flooding	0.40	Flooding	1.00
WhA:							
Wheatwood	90	Somewhat limited		Somewhat limited		Very limited	
		Flooding	0.40	Flooding	0.40	Flooding	1.00
WoC:							
Woodward	85	Not limited		Not limited		Somewhat limited	
						Depth to bedrock	0.01
WoD:							
Woodward	80	Not limited		Not limited		Somewhat limited	
						Depth to bedrock	0.16
WQF:							
Woodward	69	Very limited		Very limited		Somewhat limited	
		Water erosion	1.00	Water erosion	1.00	Depth to bedrock	0.65
						Slope	0.16

Table 13.--Paths, Trails, and Golf Course Fairways--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf course fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Quinlan	23	Very limited		Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00	Depth to bedrock	1.00
						Droughty	0.45
						Slope	0.16
WQG:							
Woodward	34	Very limited		Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00	Slope	1.00
		Slope	0.18			Depth to bedrock	0.54
Quinlan	29	Very limited		Very limited		Very limited	
		Slope	1.00	Water erosion	1.00	Depth to bedrock	1.00
		Water erosion	1.00			Slope	1.00
						Droughty	0.63
Rough broken land	19	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Slope	0.04	Depth to bedrock	1.00
						Droughty	1.00
						Slope	1.00
						Large stones content	0.01
YmA:							
Yomont	90	Not limited		Not limited		Somewhat limited	
						Flooding	0.60
YtA:							
Yomont	80	Somewhat limited		Somewhat limited		Very limited	
		Flooding	0.40	Flooding	0.40	Flooding	1.00

Table 14.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	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
AcA									
Acme	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
AsC									
Aspermont	Good	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Good
BKF:									
Badland	Very poor	Very poor	Very 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
BmA									
Beckman	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Poor	Poor
CaA									
Carey	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair
CKF:									
Cottonwood	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor
Knoco	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
DeC									
Delwin	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good
DvD									
Devol	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair
EnB									
Enterprise	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
EnC									
Enterprise	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
FoA									
Foursixes	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair
FrB									
Frankirk	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair
GdB									
Granfield	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	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
GdC2									
Grandfield	Fair	Good	Good	Good	Poor	Very poor	Fair	Very poor	Good
GfB									
Grandfield	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
GfC									
Grandfield	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
HaC									
Hardeman	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
JaC									
Jaywi	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
JeE									
Jester	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good
KgA									
Kingco	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Poor	Fair
KVD:									
Knoco	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
Vernon	Fair	Fair	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair
LaA									
Lazare	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Fair	Poor
LnA									
Lincoln	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
M-W:									
Miscellaneous water	---	---	---	---	---	---	---	---	---
MfA									
Miles	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
NoC									
Nobscot	Poor	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good
NpB									
Nipsum	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
ObC									
Obaro	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	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
PdB Paducah	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair
QnB Quanah	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
QTD Quanah	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair
Talpa	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
QuG: Quinlan	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
Rock outcrop	---	---	---	---	---	---	---	---	---
RCG: Rock outcrop	---	---	---	---	---	---	---	---	---
Cottonwood	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor
ShB Shrewder	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
ShC Shrewder	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
SpA St. Paul	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
TaC Talpa	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
TKG: Talpa	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Knoco	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor
TQB: Talpa	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Quanah	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	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
TvB Tilvern	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
W: Water	---	---	---	---	---	---	---	---	---
WcA Westill	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
WeA Westola	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
WfA Westola	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair
WhA Wheatwood	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair
WoC Woodward	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
WoD Woodward	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
WQF: Woodward	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair
Quinlan	Poor	Poor	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor
WQG: Woodward	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair
Quinlan	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
Rough broken land	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
YmA Yomont	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
YtA Yomont	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair

Table 15.--Dwellings and Small Commercial Buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Not limited		Not limited		Not limited	
AsC:							
Aspermont	85	Somewhat limited		Very limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	1.00	Shrink-swell	0.50
BKF:							
Badland	59	Not rated		Not rated		Not rated	
Knoco	25	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	0.63	Slope	1.00
BmA:							
Beckman	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
CaA:							
Carey	90	Not limited		Not limited		Not limited	
CKF:							
Cottonwood	55	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	0.63	Slope	1.00
Knoco	30	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	0.63	Slope	1.00
DeC:							
Delwin	90	Not limited		Not limited		Not limited	
DvD:							
Devol	85	Not limited		Not limited		Somewhat limited	
						Slope	0.28
EnB:							
Enterprise	85	Not limited		Not limited		Not limited	
EnC:							
Enterprise	85	Not limited		Not limited		Not limited	
FoA:							
Foursixes	80	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.95	Depth to hard bedrock	1.00	Depth to hard bedrock	0.95
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FrB:							
Frankirk	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
GdB:							
Grandfield	90	Not limited		Not limited		Not limited	
GdC2:							
Grandfield, moderately eroded	85	Not limited		Not limited		Not limited	
GfB:							
Grandfield	85	Not limited		Not limited		Not limited	
GfC:							
Grandfield	92	Not limited		Not limited		Not limited	
HaC:							
Hardeman	85	Not limited		Not limited		Not limited	
JaC:							
Jaywi	80	Not limited		Not limited		Not limited	
JeE:							
Jester	90	Not limited		Not limited		Somewhat limited	
						Slope	0.97
KgA:							
Kingco	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
KVD:							
Knoco	35	Somewhat limited		Very limited		Somewhat limited	
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
						Slope	0.50
Vernon	25	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
				Depth to soft bedrock	0.54		
LaA:							
Lazare	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
LnA:							
Lincoln	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles	85	Not limited		Not limited		Not limited	

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NoC:							
Nobscot	80	Not limited		Not limited		Not limited	
NpB:							
Nipsum	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
ObC:							
Obaro	85	Not limited		Somewhat limited		Not limited	
				Depth to soft bedrock	0.01		
PdB:							
Paducah	85	Not limited		Not limited		Not limited	
QnB:							
Quanah	85	Not limited		Not limited		Not limited	
QTD:							
Quanah	54	Not limited		Not limited		Not limited	
Talpa	36	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.50
QUG:							
Quinlan	56	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00	Slope	1.00
		Depth to soft bedrock	0.50	Slope	1.00	Depth to soft bedrock	1.00
Rock outcrop	19	Not rated		Not rated		Not rated	
RCG:							
Rock outcrop	47	Not rated		Not rated		Not rated	
Cottonwood	39	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
ShB:							
Shrewder	90	Not limited		Not limited		Not limited	
ShC:							
Shrewder	85	Not limited		Not limited		Not limited	
SpA:							
St. Paul	85	Not limited		Somewhat limited		Not limited	
				Shrink-swell	0.50		
TaC:							
Talpa	80	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TKG:							
Talpa	63	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
Knoco	24	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	1.00	Slope	1.00
Rock outcrop	7	Not rated		Not rated		Not rated	
TQB:							
Talpa	41	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Quanah	30	Not limited		Not limited		Not limited	
TvB:							
Tilvern	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
WeA:							
Westola	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
WfA:							
Westola	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
WhA:							
Wheatwood	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
WoC:							
Woodward	85	Not limited		Somewhat limited		Not limited	
				Depth to soft bedrock	0.01		
WoD:							
Woodward	80	Not limited		Somewhat limited		Somewhat limited	
				Depth to soft bedrock	0.15	Slope	0.72
WQF:							
Woodward	69	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.16	Depth to soft bedrock	0.64	Slope	1.00
				Slope	0.16		

Table 15.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Quinlan	23	Somewhat limited		Very limited		Very limited	
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.16	Slope	0.16	Slope	1.00
WQG:							
Woodward	34	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
				Depth to soft bedrock	0.54		
Quinlan	29	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Slope	1.00	Slope	1.00
Rough broken land	19	Not rated		Not rated		Not rated	
YmA:							
Yomont	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
YtA:							
Yomont	80	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
AsC:							
Aspermont	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Too clayey	0.50		
		Shrink-swell	0.50	Cutbanks cave	0.10		
BKF:							
Badland	59	Not rated		Not rated		Not rated	
Knoco	25	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	0.63	Too clayey	1.00
		Slope	0.63	Too clayey	0.50	Droughty	0.93
				Dense layer	0.50	Slope	0.63
				Cutbanks cave	0.10		
BmA:							
Beckman	90	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.80	Flooding	1.00
		Low strength	1.00	Too clayey	0.50	Too clayey	1.00
		Shrink-swell	1.00	Cutbanks cave	0.10	Salinity	0.01
CaA:							
Carey	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
CKF:							
Cottonwood	55	Somewhat limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Slope	0.63	Slope	0.63	Droughty	1.00
						Slope	0.63
Knoco	30	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	0.63	Droughty	0.64
		Slope	0.63	Too clayey	0.50	Slope	0.63
				Dense layer	0.50		
				Cutbanks cave	0.10		
DeC:							
Delwin	90	Not limited		Somewhat limited		Somewhat limited	
				Cutbanks cave	0.10	Too sandy	0.50
						Droughty	0.01
DvD:							
Devol	85	Not limited		Very limited		Not limited	
				Cutbanks cave	1.00		
EnB:							
Enterprise	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EnC:							
Enterprise	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
FoA:							
Foursixes	80	Very limited		Very limited		Somewhat limited	
		Low strength	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.95
		Depth to hard bedrock	0.95	Cutbanks cave	0.10	Droughty	0.03
		Shrink-swell	0.50	Too clayey	0.04		
FrB:							
Frankirk	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.50				
GdB:							
Grandfield	90	Not limited		Very limited		Not limited	
				Cutbanks cave	1.00		
GdC2:							
Grandfield, moderately eroded	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
GfB:							
Grandfield	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
GfC:							
Grandfield	92	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
HaC:							
Hardeman	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
JaC:							
Jaywi	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
JeE:							
Jester	90	Not limited		Very limited		Somewhat limited	
				Cutbanks cave	1.00	Droughty	0.99
KgA:							
Kingco	85	Very limited		Very limited		Not limited	
		Low strength	1.00	Cutbanks cave	1.00		
		Shrink-swell	1.00	Too clayey	0.28		
KVD:							
Knoco	35	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Too clayey	0.50	Too clayey	1.00
				Dense layer	0.50	Droughty	0.71
				Cutbanks cave	0.10		

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Vernon	25	Very limited		Somewhat limited		Very limited	
		Shrink-swell	1.00	Depth to soft bedrock	0.54	Sodium content	1.00
		Low strength	1.00	Too clayey	0.50	Depth to bedrock	0.54
				Dense layer	0.50	Droughty	0.22
				Cutbanks cave	0.10		
LaA:							
Lazare	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Low strength	1.00	Cutbanks cave	1.00	Too clayey	1.00
		Shrink-swell	1.00	Too clayey	0.32		
LnA:							
Lincoln	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	1.00
				Flooding	0.80	Droughty	0.97
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
NoC:							
Nobscot	80	Not limited		Very limited		Somewhat limited	
				Cutbanks cave	1.00	Too sandy	0.50
						Droughty	0.18
NpB:							
Nipsum	90	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Too clayey	0.12	Too clayey	1.00
		Shrink-swell	0.50	Cutbanks cave	0.10		
ObC:							
Obaro	85	Very limited		Somewhat limited		Somewhat limited	
		Low strength	1.00	Dense layer	0.50	Depth to bedrock	0.01
				Cutbanks cave	0.10		
				Depth to soft bedrock	0.01		
PdB:							
Paducah	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
QnB:							
Quanah	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
QTD:							
Quanah	54	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Talpa	36	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Too clayey	0.50	Droughty	1.00
				Dense layer	0.50		
				Cutbanks cave	0.10		
QUG:							
Quinlan	56	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
				Dense layer	0.50	Droughty	0.79
Rock outcrop	19	Not rated		Not rated		Not rated	
RCG:							
Rock outcrop	47	Not rated		Not rated		Not rated	
Cottonwood	39	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
				Cutbanks cave	0.10	Droughty	1.00
ShB:							
Shrewder	90	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
ShC:							
Shrewder	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
SpA:							
St. Paul	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
TaC:							
Talpa	80	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Too clayey	0.50	Droughty	1.00
				Dense layer	0.50		
				Cutbanks cave	0.10		
TKG:							
Talpa	63	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Droughty	1.00
		Low strength	1.00	Too clayey	0.50	Slope	1.00
				Dense layer	0.50		
Knoco	24	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	1.00	Too clayey	1.00
		Slope	1.00	Too clayey	0.50	Slope	1.00
				Dense layer	0.50	Droughty	0.86
				Cutbanks cave	0.10	Large stones content	0.16

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Rock outcrop	7	Not rated		Not rated		Not rated	
TQB:							
Talpa	41	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Too clayey	0.50	Droughty	1.00
				Dense layer	0.50		
				Cutbanks cave	0.10		
Quanah	30	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
TvB:							
Tilvern	85	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Too clayey	0.32	Sodium content	1.00
		Shrink-swell	1.00	Cutbanks cave	0.10		
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Cutbanks cave	0.10		
		Low strength	1.00	Too clayey	0.03		
WeA:							
Westola	85	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	0.60
				Flooding	0.60		
WfA:							
Westola	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	1.00
				Flooding	0.80		
WhA:							
Wheatwood	90	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.80	Flooding	1.00
				Cutbanks cave	0.10		
WoC:							
Woodward	85	Not limited		Somewhat limited		Somewhat limited	
				Dense layer	0.50	Depth to bedrock	0.01
				Depth to soft bedrock	0.01		
WoD:							
Woodward	80	Not limited		Somewhat limited		Somewhat limited	
				Dense layer	0.50	Depth to bedrock	0.16
				Depth to soft bedrock	0.15		
WQF:							
Woodward	69	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.16	Depth to soft bedrock	0.64	Depth to bedrock	0.65
				Dense layer	0.50	Slope	0.16
				Slope	0.16		

Table 16.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Quinlan	23	Somewhat limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Slope	0.16	Dense layer	0.50	Droughty	0.45
				Slope	0.16	Slope	0.16
WQG:							
Woodward	34	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
				Depth to soft bedrock	0.54	Depth to bedrock	0.54
				Dense layer	0.50		
Quinlan	29	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
				Dense layer	0.50	Droughty	0.63
Rough broken land	19	Not rated		Not rated		Very limited	
						Depth to bedrock	1.00
						Droughty	1.00
						Slope	1.00
						Large stones content	0.01
YmA:							
Yomont	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	0.60
				Flooding	0.60		
YtA:							
Yomont	80	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.80	Flooding	1.00
				Cutbanks cave	0.10		

Table 17.--Sewage Disposal

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:					
Acme	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50		
AsC:					
Aspermont	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Depth to soft bedrock	0.84
		Depth to bedrock	0.94	Seepage	0.50
				Slope	0.18
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Slope	0.63		
BmA:					
Beckman	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
CaA:					
Carey	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
		Depth to bedrock	0.06		
CKF:					
Cottonwood	55	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.63	Slope	1.00
				Seepage	1.00
Knoco	30	Very limited		Very limited	
		Slow water movement	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Slope	0.63		
DeC:					
Delwin	90	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
				Slope	0.08

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
DvD:					
Devol	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.82
EnB:					
Enterprise	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
EnC:					
Enterprise	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.32
FoA:					
Foursixes	80	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Depth to soft bedrock	0.61
				Seepage	0.21
FrB:					
Frankirk	90	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
		Seepage, bottom layer	1.00		
GdB:					
Grandfield	90	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50		
GdC2:					
Grandfield, moderately eroded	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50	Slope	0.18
GfB:					
Grandfield	85	Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	0.50
		Slow water movement	0.50		
GfC:					
Grandfield	92	Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	0.50
		Slow water movement	0.50	Slope	0.32

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
HaC:					
Hardeman	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.08
JaC:					
Jaywi	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.32	Seepage	0.68
				Slope	0.18
JeE:					
Jester	90	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
		Filtering capacity	1.00	Slope	1.00
KgA:					
Kingco	85	Very limited		Not limited	
		Slow water movement	1.00		
KVD:					
Knoco	35	Very limited		Very limited	
		Slow water movement	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	0.92
Vernon	25	Very limited		Very limited	
		Slow water movement	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	0.08
LaA:					
Lazare	85	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00
		Ponding	1.00	Depth to saturated zone	1.00
		Depth to saturated zone	1.00		
LnA:					
Lincoln	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Filtering capacity	1.00		
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
NoC:					
Nobscot	80	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.08
NpB:					
Nipsum	90	Very limited		Not limited	
		Slow water movement	1.00		
ObC:					
Obaro	85	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Seepage	0.50
				Slope	0.02
PdB:					
Paducah	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
		Depth to bedrock	0.18		
QnB:					
Quanah	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
QTD:					
Quanah	54	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.32
Talpa	36	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.92
				Seepage	0.21
QUG:					
Quinlan	56	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	1.00	Seepage	0.50
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	1.00

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ShB:					
Shrewder	90	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
		Seepage, bottom layer	1.00		
		Depth to bedrock	0.09		
ShC:					
Shrewder	85	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
		Seepage, bottom layer	1.00	Slope	0.32
		Depth to bedrock	0.27		
SpA:					
St. Paul	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
TaC:					
Talpa	80	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	0.21
				Slope	0.08
TKG:					
Talpa	63	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.21
Knoco	24	Very limited		Very limited	
		Slow water movement	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Slope	1.00		
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Seepage	0.50
Quanah	30	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
TvB:					
Tilvern	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Depth to soft bedrock	0.18
		Depth to bedrock	0.63		

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
W:					
Water	100	Not rated		Not rated	
WcA:					
Westill	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Depth to soft bedrock	0.01
		Depth to bedrock	0.36		
WeA:					
Westola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
WfA:					
Westola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
WhA:					
Wheatwood	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
WoC:					
Woodward	85	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Seepage	0.50
				Slope	0.18
WoD:					
Woodward	80	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	0.98
				Seepage	0.50
WQF:					
Woodward	69	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	0.16	Seepage	0.50
Quinlan	23	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	0.16	Seepage	0.50

Table 17.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WQG:					
Woodward	34	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	1.00	Seepage	0.50
Quinlan	29	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	1.00	Seepage	0.50
Rough broken land	19	Not rated		Very limited	
				Depth to soft bedrock	1.00
				Slope	1.00
				Seepage	1.00
YmA:					
Yomont	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
YtA:					
Yomont	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00

Table 18.--Landfills

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme----------------	85	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.63
AsC:							
Aspermont-----------	85	Very limited		Somewhat limited		Somewhat limited	
		Depth to bedrock	1.00	Depth to bedrock	0.84	Depth to bedrock	0.84
		Too clayey	1.00			Too clayey	0.50
BKF:							
Badland-------------	59	Not rated		Very limited		Not rated	
				Depth to bedrock	1.00		
				Slope	0.63		
Knoco---------------	25	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Slope	0.63	Depth to bedrock	1.00
		Slope	0.63			Slope	0.63
BmA:							
Beckman-------------	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Too clayey	1.00
		Too clayey	1.00				
CaA:							
Carey---------------	90	Very limited		Not limited		Not limited	
		Depth to bedrock	1.00				
CKF:							
Cottonwood----------	55	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.63	Seepage	1.00	Seepage	1.00
				Slope	0.63	Slope	0.63
Knoco---------------	30	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Slope	0.63	Depth to bedrock	1.00
		Slope	0.63			Slope	0.63
DeC:							
Delwin--------------	90	Not limited		Not limited		Not limited	
DvD:							
Devol---------------	85	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.50
		Too sandy	0.50			Too sandy	0.50
EnB:							
Enterprise----------	85	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.50
EnC:							
Enterprise----------	85	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.50

Table 18.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FoA:							
Foursixes	80	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
FrB:							
Frankirk	90	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
		Seepage, bottom layer	1.00				
GdB:							
Grandfield	90	Very limited		Not limited		Somewhat limited	
		Seepage, bottom layer	1.00			Seepage	0.50
GdC2:							
Grandfield, moderately eroded	85	Very limited		Not limited		Not limited	
		Seepage, bottom layer	1.00				
GfB:							
Grandfield	85	Very limited		Not limited		Not limited	
		Seepage, bottom layer	1.00				
GfC:							
Grandfield	92	Very limited		Not limited		Not limited	
		Seepage, bottom layer	1.00				
HaC:							
Hardeman	85	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.50
JaC:							
Jaywi	80	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
JeE:							
Jester	90	Very limited		Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	1.00
		Too sandy	0.50			Too sandy	0.50
KgA:							
Kingco	85	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
KVD:							
Knoco	35	Very limited		Not limited		Very limited	
		Depth to bedrock	1.00			Depth to bedrock	1.00
Vernon	25	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
		Excess sodium	1.00			Sodium content	1.00

Table 18.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LaA:							
Lazare	85	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Too clayey	1.00			Too clayey	1.00
						Hard to compact	1.00
LnA:							
Lincoln	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Too sandy	1.00
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	1.00
		Too sandy	1.00				
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles	85	Not limited		Not limited		Not limited	
NoC:							
Nobscot	80	Very limited		Very limited		Somewhat limited	
		Seepage, bottom layer	1.00	Seepage	1.00	Seepage	0.50
		Too sandy	0.50			Too sandy	0.50
NpB:							
Nipsum	90	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
ObC:							
Obaro	85	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	0.50			Too clayey	0.50
PdB:							
Paducah	85	Very limited		Not limited		Somewhat limited	
		Depth to bedrock	1.00			Too clayey	0.50
		Too clayey	0.50				
QnB:							
Quanah	85	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
QTD:							
Quanah	54	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
Talpa	36	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
QUG:							
Quinlan	56	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00

Table 18.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Rock outcrop	19	Not rated		Very limited		Not rated	
				Depth to bedrock	1.00		
				Slope	1.00		
				Seepage	1.00		
RCG:							
Rock outcrop	47	Not rated		Very limited		Not rated	
				Slope	1.00		
				Depth to bedrock	1.00		
				Seepage	1.00		
Cottonwood	39	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00	Slope	1.00
				Seepage	1.00		
ShB:							
Shrewder	90	Very limited		Very limited		Somewhat limited	
		Depth to bedrock	1.00	Seepage	1.00	Seepage	0.50
		Seepage, bottom layer	1.00				
ShC:							
Shrewder	85	Very limited		Very limited		Somewhat limited	
		Depth to bedrock	1.00	Seepage	1.00	Seepage	0.50
		Seepage, bottom layer	1.00				
SpA:							
St. Paul	85	Not limited		Not limited		Somewhat limited	
						Too clayey	0.50
TaC:							
Talpa	80	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	1.00			Too clayey	1.00
TKG:							
Talpa	63	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
		Too clayey	1.00			Too clayey	1.00
Knoco	24	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Slope	1.00	Depth to bedrock	1.00
		Slope	1.00			Slope	1.00
Rock outcrop	7	Not rated		Very limited		Not rated	
				Slope	1.00		
				Depth to bedrock	1.00		
				Seepage	1.00		
TQB:							
Talpa	41	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too clayey	0.50			Too clayey	0.50
Quanah	30	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50

Table 18.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TvB:							
Tilvern	85	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	0.18	Too clayey	1.00
		Too clayey	1.00			Depth to bedrock	0.18
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	0.01	Too clayey	1.00
		Too clayey	1.00			Depth to bedrock	0.01
WeA:							
Westola	85	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Flooding	1.00	Seepage	0.50
		Seepage, bottom layer	1.00	Seepage	1.00		
WfA:							
Westola	85	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Flooding	1.00	Seepage	0.50
		Seepage, bottom layer	1.00	Seepage	1.00		
WhA:							
Wheatwood	90	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
WoC:							
Woodward	85	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
WoD:							
Woodward	80	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
WQF:							
Woodward	69	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.16	Slope	0.16	Slope	0.16
Quinlan	23	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.16	Slope	0.16	Slope	0.16
WQG:							
Woodward	34	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
Quinlan	29	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
Rough broken land	19	Not rated		Very limited		Not rated	
				Depth to bedrock	1.00		
				Slope	1.00		
				Seepage	1.00		

Table 18.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
YmA:							
Yomont	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Flooding	1.00	Seepage	0.50
		Seepage, bottom layer	1.00	Seepage	1.00		
YtA:							
Yomont	80	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Flooding	1.00	Seepage	0.50
		Seepage, bottom layer	1.00	Seepage	1.00		

Table 19.--Source of Gravel and Sand

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
AcA:					
Acme	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
AsC:					
Aspermont	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BmA:					
Beckman	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CaA:					
Carey	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CKF:					
Cottonwood	55	Poor		Poor	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.00	Bottom layer	0.00
Knoco	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
DeC:					
Delwin	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
DvD:					
Devol	85	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.03
		Thickest layer	0.00	Bottom layer	0.10
EnB:					
Enterprise	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 19.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
EnC:					
Enterprise	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
FoA:					
Foursixes	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
FrB:					
Frankirk	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.06
GdB:					
Grandfield	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.12
GdC2:					
Grandfield, moderately eroded	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
GfB:					
Grandfield	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
GfC:					
Grandfield	92	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
HaC:					
Hardeman	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
JaC:					
Jaywi	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
JeE:					
Jester	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.11
		Thickest layer	0.00	Thickest layer	0.11
KgA:					
Kingco	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
KVD:					
Knoco	35	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 19.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
Vernon	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LaA:					
Lazare	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LnA:					
Lincoln	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.11
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
NoC:					
Nobscot	80	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.10
		Thickest layer	0.00	Thickest layer	0.64
NpB:					
Nipsum	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ObC:					
Obaro	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PdB:					
Paducah	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
QnB:					
Quanah	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
QTD:					
Quanah	54	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Talpa	36	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
QUG:					
Quinlan	56	Not rated		Not rated	

Table 19.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ShB:					
Shrewder	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ShC:					
Shrewder	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
SpA:					
St. Paul	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
TaC:					
Talpa	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
TKG:					
Talpa	63	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Knoco	24	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Quanah	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
TvB:					
Tilvern	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
W:					
Water	100	Not rated		Not rated	
WcA:					
Westill	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 19.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
WeA:					
Westola	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
WfA:					
Westola	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
WhA:					
Wheatwood	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
WoC:					
Woodward	85	Not rated		Not rated	
WoD:					
Woodward	80	Not rated		Not rated	
WQF:					
Woodward	69	Not rated		Not rated	
Quinlan	23	Not rated		Not rated	
WQG:					
Woodward	34	Not rated		Not rated	
Quinlan	29	Not rated		Not rated	
Rough broken land	19	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
YmA:					
Yomont	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
YtA:					
Yomont	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Fair		Good		Good	
		Organic matter content low	0.12				
		Water erosion	0.99				
AsC:							
Aspermont	85	Fair		Poor		Fair	
		Organic matter content low	0.12	Low strength	0.00	Carbonate content	0.98
		Carbonate content	0.68	Depth to bedrock	0.16		
		Water erosion	0.99	Shrink-swell	0.69		
BKF:							
Badland	59	Not rated		Not rated		Not rated	
Knoco	25	Poor		Poor		Poor	
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Too clayey	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Droughty	0.01			Too clayey	0.00
		Organic matter content low	0.05			Slope	0.37
BmA:							
Beckman	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Salinity	0.00
		Organic matter content low	0.50	Shrink-swell	0.12	Too clayey	0.00
		Salinity	0.88			Sodium content	0.98
		Sodium content	0.97				
		Water erosion	0.99				
CaA:							
Carey	90	Fair		Good		Good	
		Organic matter content low	0.18				
		Water erosion	0.99				
CKF:							
Cottonwood	55	Poor		Poor		Poor	
		Depth to bedrock	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Slope	0.37
		Organic matter content low	0.88			Carbonate content	0.97
		Carbonate content	0.97				
Knoco	30	Poor		Poor		Poor	
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Organic matter content low	0.05			Hard to reclaim (dense layer)	0.00
		Droughty	0.10			Slope	0.37
		Water erosion	0.99				

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DeC:							
Delwin---------------	90	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.88				
DvD:							
Devol----------------	85	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.12				
EnB:							
Enterprise-----------	85	Fair		Good		Good	
		Organic matter content low	0.18				
		Water erosion	0.90				
EnC:							
Enterprise-----------	85	Fair		Good		Good	
		Organic matter content low	0.18				
		Water erosion	0.90				
FoA:							
Foursixes------------	80	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Depth to bedrock	0.05	Low strength	0.00	Depth to bedrock	0.05
		Droughty	0.13	Shrink-swell	0.87		
		Organic matter content low	0.18				
FrB:							
Frankirk-------------	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Water erosion	0.99	Shrink-swell	0.90		
GdB:							
Grandfield-----------	90	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.50				
GdC2:							
Grandfield, moderately eroded--	85	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.50				
GfB:							
Grandfield-----------	85	Fair		Good		Good	
		Organic matter content low	0.50				
GfC:							
Grandfield-----------	92	Fair		Good		Good	
		Organic matter content low	0.50				

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
HaC:							
Hardeman	85	Fair		Good		Good	
		Organic matter content low	0.18				
JaC:							
Jaywi	80	Fair		Poor		Good	
		Organic matter content low	0.12	Low strength	0.00		
		Water erosion	0.99				
JeE:							
Jester	90	Poor		Good		Poor	
		Wind erosion	0.00			Too sandy	0.00
		Too sandy	0.00				
		Organic matter content low	0.18				
		Droughty	0.30				
KgA:							
Kingco	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
				Shrink-swell	0.12		
KVD:							
Knoco	35	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Depth to bedrock	0.00	Low strength	0.00	Hard to reclaim (dense layer)	0.00
		Organic matter content low	0.05			Depth to bedrock	0.00
		Droughty	0.08				
Vernon	25	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Depth to bedrock	0.46	Low strength	0.00	Hard to reclaim (dense layer)	0.05
		Organic matter content low	0.60	Shrink-swell	0.12	Depth to bedrock	0.46
		Droughty	0.78				
		Water erosion	0.99				
LaA:							
Lazare	85	Poor		Poor		Poor	
		Too clayey	0.00	Wetness depth	0.00	Too clayey	0.00
		Organic matter content low	0.60	Low strength	0.00	Wetness depth	0.00
		Water erosion	0.99	Shrink-swell	0.00		
LnA:							
Lincoln	90	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.22
		Organic matter content low	0.12				
		Too sandy	0.22				
		Droughty	0.38				
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MfA:							
Miles	85	Fair		Good		Good	
		Organic matter content low	0.12				
NoC:							
Nobscot	80	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.88				
NpB:							
Nipsum	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
				Shrink-swell	0.87		
ObC:							
Obaro	85	Fair		Poor		Poor	
		Organic matter content low	0.60	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Water erosion	0.90	Low strength	0.00	Depth to bedrock	0.99
		Droughty	0.99				
		Depth to bedrock	0.99				
PdB:							
Paducah	85	Fair		Poor		Poor	
		Organic matter content low	0.18	Low strength	0.00	Hard to reclaim (dense layer)	0.00
		Water erosion	0.90				
QnB:							
Quanah	85	Fair		Poor		Fair	
		Carbonate content	0.01	Low strength	0.00	Too clayey	0.93
		Organic matter content low	0.18				
		Too clayey	0.98				
		Water erosion	0.99				
QTD:							
Quanah	54	Fair		Poor		Good	
		Carbonate content	0.01	Low strength	0.00		
		Organic matter content low	0.18				
		Water erosion	0.99				
Talpa	36	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Carbonate content	0.68			Rock fragments	0.12
						Carbonate content	0.68
QUG:							
Quinlan	56	Not rated		Poor		Not rated	
				Depth to bedrock	0.00		
				Slope	0.00		
Rock outcrop	19	Not rated		Not rated		Not rated	

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RCG:							
Rock outcrop	47	Not rated		Not rated		Not rated	
Cottonwood	39	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Slope	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
		Organic matter content low	0.88			Carbonate content	0.97
		Carbonate content	0.97				
ShB:							
Shrewder	90	Fair		Good		Good	
		Organic matter content low	0.12				
ShC:							
Shrewder	85	Fair		Good		Good	
		Organic matter content low	0.12				
SpA:							
St. Paul	85	Fair		Poor		Good	
		Water erosion	0.99	Low strength	0.00		
				Shrink-swell	0.98		
TaC:							
Talpa	80	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Carbonate content	0.68			Rock fragments	0.28
						Carbonate content	0.68
TKG:							
Talpa	63	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
		Carbonate content	0.68	Low strength	0.00	Slope	0.00
						Rock fragments	0.32
						Carbonate content	0.68
Knoco	24	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Depth to bedrock	0.00	Low strength	0.00	Hard to reclaim (dense layer)	0.00
		Droughty	0.03	Slope	0.00	Depth to bedrock	0.00
		Organic matter content low	0.05			Slope	0.00
Rock outcrop	7	Not rated		Not rated		Not rated	
TQB:							
Talpa	41	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.00
		Depth to bedrock	0.00	Low strength	0.00	Depth to bedrock	0.00
		Carbonate content	0.68			Rock fragments	0.28
						Carbonate content	0.68

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Quanah	30	Fair		Poor		Good	
		Carbonate content	0.46	Low strength	0.00		
		Organic matter content low	0.88				
		Water erosion	0.99				
TvB:							
Tilvern	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.12	Shrink-swell	0.12	Sodium content	0.78
		Sodium content	0.78	Depth to bedrock	0.82		
		Water erosion	0.99				
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.18	Shrink-swell	0.12	Hard to reclaim (dense layer)	0.03
		Carbonate content	0.99	Depth to bedrock	0.99		
WeA:							
Westola	85	Fair		Good		Good	
		Organic matter content low	0.12				
WfA:							
Westola	85	Fair		Good		Good	
		Organic matter content low	0.12				
WhA:							
Wheatwood	90	Fair		Poor		Good	
		Water erosion	0.90	Low strength	0.00		
WoC:							
Woodward	85	Poor		Poor		Fair	
		Organic matter content low	0.00	Depth to bedrock	0.00	Depth to bedrock	0.99
		Depth to bedrock	0.99			Hard to reclaim (dense layer)	0.99
		Water erosion	0.99				
WoD:							
Woodward	80	Poor		Poor		Fair	
		Organic matter content low	0.00	Depth to bedrock	0.00	Depth to bedrock	0.84
		Depth to bedrock	0.84			Hard to reclaim (dense layer)	0.84
		Water erosion	0.99				
WQF:							
Woodward	69	Poor		Poor		Fair	
		Organic matter content low	0.00	Depth to bedrock	0.00	Hard to reclaim (dense layer)	0.35
		Depth to bedrock	0.35			Depth to bedrock	0.35

Table 20.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
		Droughty	0.94			Slope	0.84
		Water erosion	0.99				
Quinlan	23	Not rated		Poor		Not rated	
				Depth to bedrock	0.00		
WQG:							
Woodward	34	Poor		Poor		Poor	
		Organic matter content low	0.00	Depth to bedrock	0.00	Slope	0.00
		Depth to bedrock	0.46	Slope	0.82	Hard to reclaim (dense layer)	0.46
		Droughty	0.98			Depth to bedrock	0.46
		Water erosion	0.99				
Quinlan	29	Not rated		Poor		Not rated	
				Depth to bedrock	0.00		
				Slope	0.00		
Rough broken land	19	Not rated		Poor		Not rated	
				Depth to bedrock	0.00		
				Slope	0.00		
YmA:							
Yomont	90	Fair		Good		Good	
		Organic matter content low	0.18				
		Water erosion	0.68				
YtA:							
Yomont	80	Fair		Good		Good	
		Organic matter content low	0.18				
		Water erosion	0.68				

Table 21.--Ponds and Embankments

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:							
Acme	85	Very limited Gypsum content Seepage	 1.00 1.00	Very limited Piping	 1.00	Very limited Depth to water	 1.00
AsC:							
Aspermont	85	Somewhat limited Seepage Depth to bedrock	 0.70 0.01	Somewhat limited Piping	 0.78	Very limited Depth to water	 1.00
BKF:							
Badland	59	Very limited Depth to bedrock Slope	 1.00 0.01	Not rated		Not rated	
Knoco	25	Somewhat limited Depth to bedrock Slope	 0.74 0.01	Not limited		Very limited Depth to water	 1.00
BmA:							
Beckman	90	Not limited		Somewhat limited Hard to pack Salinity	 0.62 0.12	Very limited Depth to water	 1.00
CaA:							
Carey	90	Somewhat limited Seepage	 0.70	Very limited Piping	 1.00	Very limited Depth to water	 1.00
CKF:							
Cottonwood	55	Very limited Seepage Depth to bedrock Slope	 1.00 0.96 0.01	Very limited Thin layer Piping	 1.00 1.00	Very limited Depth to water	 1.00
Knoco	30	Somewhat limited Depth to bedrock Slope	 0.78 0.01	Not limited		Very limited Depth to water	 1.00
DeC:							
Delwin	90	Somewhat limited Seepage	 0.70	Not limited		Very limited Depth to water	 1.00
DvD:							
Devol	85	Very limited Seepage	 1.00	Somewhat limited Seepage	 0.10	Very limited Depth to water	 1.00
EnB:							
Enterprise	85	Very limited Seepage	 1.00	Very limited Piping	 1.00	Very limited Depth to water	 1.00
EnC:							
Enterprise	85	Very limited Seepage	 1.00	Very limited Piping	 1.00	Very limited Depth to water	 1.00

Table 21.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FoA:							
Foursixes	80	Somewhat limited		Somewhat limited		Very limited	
		Depth to bedrock	0.99	Thin layer	0.99	Depth to water	1.00
		Seepage	0.45	Piping	0.08		
FrB:							
Frankirk	90	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.34	Depth to water	1.00
				Seepage	0.06		
GdB:							
Grandfield	90	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.12	Depth to water	1.00
GdC2:							
Grandfield, moderately eroded	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
GfB:							
Grandfield	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
GfC:							
Grandfield	92	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
HaC:							
Hardeman	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
JaC:							
Jaywi	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.81	Piping	0.68	Depth to water	1.00
JeE:							
Jester	90	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.11	Depth to water	1.00
KgA:							
Kingco	85	Not limited		Somewhat limited		Very limited	
				Piping	0.02	Depth to water	1.00
KVD:							
Knoco	35	Somewhat limited		Not limited		Very limited	
		Depth to bedrock	0.61			Depth to water	1.00
Vernon	25	Somewhat limited		Very limited		Very limited	
		Depth to bedrock	0.13	Piping	1.00	Depth to water	1.00
LaA:							
Lazare	85	Not limited		Very limited		Very limited	
				Ponding	1.00	Depth to water	1.00
				Depth to saturated zone	1.00		
				Hard to pack	1.00		
LnA:							
Lincoln	90	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.11	Depth to water	1.00

Table 21.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
MfA:							
Miles	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
NoC:							
Nobscot	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.64	Depth to water	1.00
NpB:							
Nipsum	90	Not limited		Not limited		Very limited	
						Depth to water	1.00
ObC:							
Obaro	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.21	Depth to water	1.00
		Depth to bedrock	0.02				
PdB:							
Paducah	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.92	Depth to water	1.00
QnB:							
Quanah	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.68	Depth to water	1.00
QTD:							
Quanah	54	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.68	Depth to water	1.00
Talpa	36	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.45	Piping	0.18		
QUG:							
Quinlan	56	Somewhat limited		Somewhat limited		Very limited	
		Depth to bedrock	0.61	Piping	0.02	Depth to water	1.00
		Slope	0.45				
		Seepage	0.03				
Rock outcrop	19	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Seepage	1.00				
		Slope	0.45				
RCG:							
Rock outcrop	47	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Seepage	1.00				
		Slope	0.64				
Cottonwood	39	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	1.00	Piping	1.00		
		Slope	0.64				

Table 21.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ShB:							
Shrewder	90	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
ShC:							
Shrewder	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
SpA:							
St. Paul	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.69	Depth to water	1.00
TaC:							
Talpa	80	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.45	Piping	0.18		
TKG:							
Talpa	63	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.36	Piping	0.18		
Knoco	24	Somewhat limited		Not limited		Very limited	
		Depth to bedrock	0.69			Depth to water	1.00
		Slope	0.36				
Rock outcrop	7	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Seepage	1.00				
		Slope	0.64				
TQB:							
Talpa	41	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.45	Piping	0.18		
Quanah	30	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.68	Depth to water	1.00
TvB:							
Tilvern	85	Somewhat limited		Very limited		Very limited	
		Depth to bedrock	0.01	Piping	1.00	Depth to water	1.00
W:							
Water	100	Not rated		Not rated		Not rated	
WcA:							
Westill	85	Somewhat limited		Not limited		Very limited	
		Depth to bedrock	0.01			Depth to water	1.00
WeA:							
Westola	85	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
WfA:							
Westola	85	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00

Table 21.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
WhA:							
Wheatwood	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.83	Depth to water	1.00
WoC:							
Woodward	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
		Depth to bedrock	0.02				
WoD:							
Woodward	80	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
		Depth to bedrock	0.05				
WQF:							
Woodward	69	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
		Depth to bedrock	0.17				
Quinlan	23	Somewhat limited		Not limited		Very limited	
		Depth to bedrock	0.61			Depth to water	1.00
		Seepage	0.03				
WQG:							
Woodward	34	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
		Depth to bedrock	0.13				
		Slope	0.08				
Quinlan	29	Somewhat limited		Not limited		Very limited	
		Depth to bedrock	0.69			Depth to water	1.00
		Slope	0.28				
		Seepage	0.03				
Rough broken land	19	Very limited		Not rated		Not rated	
		Seepage	1.00				
		Depth to bedrock	1.00				
		Slope	0.36				
YmA:							
Yomont	90	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
YtA:							
Yomont	80	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00

Table 22.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AcA:					
Acme	85	Not limited		Very limited	
				K factor	1.00
				HEL wind	1.00
AsC:					
Aspermont	85	Somewhat limited		Very limited	
		Slope	0.26	K factor	1.00
				HEL wind	1.00
				Slope	0.26
BKF:					
Badland	59	Not rated		Not rated	
Knoco	25	Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	HEL wind	1.00
				Slope	1.00
				K factor	0.88
BmA:					
Beckman	90	Not limited		Very limited	
				K factor	1.00
				HEL wind	1.00
CaA:					
Carey	90	Not limited		Very limited	
				K factor	1.00
CKF:					
Cottonwood	55	Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	HEL wind	1.00
				Slope	1.00
				K factor	0.88
Knoco	30	Very limited		Very limited	
		Depth to soft bedrock	1.00	K factor	1.00
		Slope	1.00	Depth to soft bedrock	1.00
				HEL wind	1.00
				Slope	1.00
DeC:					
Delwin	90	Somewhat limited		Very limited	
		Slope	0.16	HEL wind	1.00
				Slope	0.16
				K factor	0.12
DvD:					
Devol	85	Somewhat limited		Very limited	
		Slope	0.74	HEL wind	1.00
				Slope	0.74

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
EnB:					
Enterprise----------	85	Somewhat limited		Very limited	
		Slope	0.04	K factor	1.00
				HEL wind	1.00
				Slope	0.04
EnC:					
Enterprise----------	85	Somewhat limited		Very limited	
		Slope	0.37	K factor	1.00
				HEL wind	1.00
				Slope	0.37
FoA:					
Foursixes-----------	80	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
				HEL wind	1.00
				K factor	0.88
FrB:					
Frankirk------------	90	Not limited		Very limited	
				K factor	1.00
GdB:					
Grandfield----------	90	Somewhat limited		Very limited	
		Slope	0.01	HEL wind	1.00
				K factor	0.88
				Slope	0.01
GdC2:					
Grandfield, moderately eroded--	85	Somewhat limited		Very limited	
		Slope	0.26	HEL wind	1.00
				K factor	0.88
				Slope	0.26
GfB:					
Grandfield----------	85	Somewhat limited		Very limited	
		Slope	0.04	HEL wind	1.00
				K factor	0.88
				Slope	0.04
GfC:					
Grandfield----------	92	Somewhat limited		Very limited	
		Slope	0.37	HEL wind	1.00
				K factor	0.88
				Slope	0.37
HaC:					
Hardeman------------	85	Somewhat limited		Very limited	
		Slope	0.16	HEL wind	1.00
				K factor	0.50
				Slope	0.16
JaC:					
Jaywi---------------	80	Somewhat limited		Very limited	
		Slope	0.26	K factor	1.00
				HEL wind	1.00
				Slope	0.26

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
JeE:					
Jester	90	Somewhat limited		Very limited	
		Slope	0.99	HEL wind	1.00
				Slope	0.99
KgA:					
Kingco	85	Not limited		Somewhat limited	
				K factor	0.88
KVD:					
Knoco	35	Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.84	HEL wind	1.00
				K factor	0.88
				Slope	0.84
Vernon	25	Somewhat limited		Very limited	
		Depth to soft bedrock	0.54	K factor	1.00
		Slope	0.16	HEL wind	1.00
				Depth to soft bedrock	0.54
				Slope	0.16
LaA:					
Lazare	85	Not limited		Very limited	
				K factor	1.00
				Ponding	1.00
				Depth to saturated zone	1.00
LnA:					
Lincoln	90	Not limited		Very limited	
				HEL wind	1.00
				Too Sandy	1.00
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
MfA:					
Miles	85	Not limited		Very limited	
				HEL wind	1.00
				K factor	0.88
NoC:					
Nobscot	80	Somewhat limited		Very limited	
		Slope	0.16	HEL wind	1.00
				Slope	0.16
NpB:					
Nipsum	90	Not limited		Very limited	
				HEL wind	1.00
				K factor	0.88

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ObC:					
Obaro	85	Somewhat limited Slope Depth to soft bedrock	 0.09 0.01	Very limited K factor HEL wind Slope Depth to soft bedrock	 1.00 1.00 0.09 0.01
PdB:					
Paducah	85	Somewhat limited Slope	 0.04	Very limited K factor Slope	 1.00 0.04
QnB:					
Quanah	85	Somewhat limited Slope	 0.04	Very limited K factor HEL wind Slope	 1.00 1.00 0.04
QTD:					
Quanah	54	Somewhat limited Slope	 0.37	Very limited K factor HEL wind Slope	 1.00 1.00 0.37
Talpa	36	Very limited Depth to hard bedrock Slope	 1.00 0.84	Very limited Depth to hard bedrock HEL wind K factor Slope	 1.00 1.00 0.88 0.84
QUG:					
Quinlan	56	Very limited Slope Depth to soft bedrock	 1.00 1.00	Very limited K factor Slope Depth to soft bedrock HEL wind	 1.00 1.00 1.00 1.00
Rock outcrop	19	Not rated		Not rated	
RCG:					
Rock outcrop	47	Not rated		Not rated	
Cottonwood	39	Very limited Depth to hard bedrock Slope	 1.00 1.00	Very limited Slope Depth to hard bedrock HEL wind K factor	 1.00 1.00 1.00 0.88
ShB:					
Shrewder	90	Somewhat limited Slope	 0.04	Very limited HEL wind K factor Slope	 1.00 0.88 0.04

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ShC:					
Shrewder	85	Somewhat limited		Very limited	
		Slope	0.37	HEL wind	1.00
				K factor	0.88
				Slope	0.37
SpA:					
St. Paul	85	Not limited		Very limited	
				K factor	1.00
TaC:					
Talpa	80	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.16	Slope	0.16
TKG:					
Talpa	63	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
				K factor	0.88
Knoco	24	Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				K factor	0.88
Rock outcrop	7	Not rated		Not rated	
TQB:					
Talpa	41	Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.04	HEL wind	1.00
				K factor	0.88
				Slope	0.04
Quanah	30	Somewhat limited		Very limited	
		Slope	0.01	K factor	1.00
				HEL wind	1.00
				Slope	0.01
TvB:					
Tilvern	85	Somewhat limited		Very limited	
		Slope	0.04	K factor	1.00
				HEL wind	1.00
				Slope	0.04
W:					
Water	100	Not rated		Not rated	
WcA:					
Westill	85	Not limited		Somewhat limited	
				K factor	0.88

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WeA:					
Westola	85	Not limited		Very limited	
				HEL wind	1.00
				K factor	0.88
WfA:					
Westola	85	Not limited		Very limited	
				HEL wind	1.00
				K factor	0.88
WhA:					
Wheatwood	90	Not limited		Very limited	
				K factor	1.00
WoC:					
Woodward	85	Somewhat limited		Very limited	
		Slope	0.26	K factor	1.00
		Depth to soft bedrock	0.01	HEL wind	1.00
				Slope	0.26
				Depth to soft bedrock	0.01
WoD:					
Woodward	80	Somewhat limited		Very limited	
		Slope	0.91	K factor	1.00
		Depth to soft bedrock	0.16	HEL wind	1.00
				Slope	0.91
				Depth to soft bedrock	0.16
WQF:					
Woodward	69	Very limited		Very limited	
		Slope	1.00	K factor	1.00
		Depth to soft bedrock	0.65	HEL wind	1.00
				Slope	1.00
				Depth to soft bedrock	0.65
Quinlan	23	Very limited		Very limited	
		Depth to soft bedrock	1.00	K factor	1.00
		Slope	1.00	Depth to soft bedrock	1.00
				HEL wind	1.00
				Slope	1.00
WQG:					
Woodward	34	Very limited		Very limited	
		Slope	1.00	K factor	1.00
		Depth to soft bedrock	0.54	HEL wind	1.00
				Slope	1.00
				Depth to soft bedrock	0.54

Table 22.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Quinlan-------------	29	Very limited		Very limited	
		Depth to soft bedrock	1.00	K factor	1.00
		Slope	1.00	Depth to soft bedrock	1.00
				HEL wind	1.00
				Slope	1.00
Rough broken land---	19	Not rated		Not rated	
YmA:					
Yomont--------------	90	Not limited		Very limited	
				K factor	1.00
				HEL wind	1.00
YtA:					
Yomont--------------	80	Not limited		Very limited	
				K factor	1.00
				HEL wind	1.00

Table 23.--Irrigation Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
AcA:			
Acme	85	Somewhat limited	
		Excess Sodium	0.02
AsC:			
Aspermont	85	Very limited	
		Percs slowly	1.00
		Slope	0.02
BKF:			
Badland	59	Not rated	
Knoco	25	Very limited	
		Percs slowly	1.00
		Bedrock	1.00
		Slope	1.00
		Droughty	0.99
		Slopes, sprinkler irrigation	0.78
BmA:			
Beckman	90	Very limited	
		Percs slowly	1.00
		Frequent flooding	0.80
		Excess Sodium	0.08
		Excess salt	0.01
CaA:			
Carey	90	Not limited	
CKF:			
Cottonwood	55	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slope	1.00
		Slopes, sprinkler irrigation	0.78
Knoco	30	Very limited	
		Percs slowly	1.00
		Bedrock	1.00
		Slope	1.00
		Droughty	0.94
		Slopes, sprinkler irrigation	0.78

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
DeC:			
Delwin	90	Not limited	
DvD:			
Devol	85	Somewhat limited	
		Slope	0.50
EnB:			
Enterprise	85	Not limited	
EnC:			
Enterprise	85	Somewhat limited	
		Slope	0.08
FoA:			
Foursixes	80	Very limited	
		Percs slowly	1.00
		Bedrock	0.95
		Droughty	0.92
FrB:			
Frankirk	90	Somewhat limited	
		Percs slowly	0.38
GdB:			
Grandfield	90	Not limited	
GdC2:			
Grandfield, moderately eroded	85	Somewhat limited	
		Slope	0.02
GfB:			
Grandfield	85	Not limited	
GfC:			
Grandfield	92	Somewhat limited	
		Slope	0.08
HaC:			
Hardeman	85	Not limited	
JaC:			
Jaywi	80	Somewhat limited	
		Slope	0.02

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
JeE:			
Jester	90	Somewhat limited	
		Slope	0.98
		Droughty	0.76
		Slopes, sprinkler irrigation	0.06
KgA:			
Kingco	85	Very limited	
		Percs slowly	1.00
KVD:			
Knoco	35	Very limited	
		Percs slowly	1.00
		Bedrock	1.00
		Droughty	0.96
		Slope	0.68
Vernon	25	Very limited	
		Percs slowly	1.00
		Bedrock	0.54
		Droughty	0.25
LaA:			
Lazare	85	Very limited	
		Percs slowly	1.00
		Ponding	1.00
		Depth to saturated zone	1.00
LnA:			
Lincoln	90	Somewhat limited	
		Frequent flooding	0.80
		Droughty	0.69
M-W:			
Water, miscellaneous	100	Not rated	
MfA:			
Miles	85	Not limited	
NoC:			
Nobscot	80	Not limited	

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
NpB:			
Nipsum	90	Very limited	
		Percs slowly	1.00
ObC:			
Obaro	85	Somewhat limited	
		Percs slowly	0.38
		Droughty	0.02
		Bedrock	0.01
PdB:			
Paducah	85	Not limited	
QnB:			
Quanah	85	Not limited	
QTD:			
Quanah	54	Somewhat limited	
		Slope	0.08
Talpa	36	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slope	0.68
QUG:			
Quinlan	56	Very limited	
		Bedrock	1.00
		Slope	1.00
		Droughty	1.00
		Slopes, sprinkler irrigation	1.00
		Percs slowly	0.38
Rock outcrop	19	Not rated	
RCG:			
Rock outcrop	47	Not rated	
Cottonwood	39	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slopes, sprinkler irrigation	1.00
		Slope	1.00
ShB:			
Shrewder	90	Not limited	
ShC:			
Shrewder	85	Somewhat limited	
		Slope	0.08
SpA:			
St. Paul	85	Somewhat limited	
		Percs slowly	0.38

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
TaC:			
Talpa	80	Very limited	
		Bedrock	1.00
		Droughty	1.00
TKG:			
Talpa	63	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slope	1.00
		Slopes, sprinkler irrigation	1.00
Knoco	24	Very limited	
		Percs slowly	1.00
		Bedrock	1.00
		Slope	1.00
		Slopes, sprinkler irrigation	1.00
		Droughty	0.99
Rock outcrop	7	Not rated	
TQB:			
Talpa	41	Very limited	
		Bedrock	1.00
		Droughty	1.00
Quanah	30	Not limited	
TvB:			
Tilvern	85	Very limited	
		Percs slowly	1.00
		Excess Sodium	0.32
W:			
Water	100	Not rated	
WcA:			
Westill	85	Very limited	
		Percs slowly	1.00
WeA:			
Westola	85	Somewhat limited	
		Occasional flooding	0.60

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
WfA:			
Westola	85	Somewhat limited	
		Frequent flooding	0.80
WhA:			
Wheatwood	90	Somewhat limited	
		Frequent flooding	0.80
WoC:			
Woodward	85	Somewhat limited	
		Percs slowly	0.38
		Slope	0.02
		Bedrock	0.01
WoD:			
Woodward	80	Somewhat limited	
		Slope	0.82
		Percs slowly	0.38
		Bedrock	0.16
		Slopes, sprinkler irrigation	0.01
WQF:			
Woodward	69	Very limited	
		Slope	1.00
		Bedrock	0.65
		Slopes, sprinkler irrigation	0.40
		Percs slowly	0.38
		Droughty	0.07
Quinlan	23	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slope	1.00
		Slopes, sprinkler irrigation	0.40
		Percs slowly	0.38
WQG:			
Woodward	34	Very limited	
		Slope	1.00
		Slopes, sprinkler irrigation	1.00
		Bedrock	0.54
		Percs slowly	0.38
		Droughty	0.02

Table 23.--Irrigation Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods	
		Rating class and limiting features	Value
Quinlan	29	Very limited	
		Bedrock	1.00
		Droughty	1.00
		Slope	1.00
		Slopes, sprinkler irrigation	1.00
		Percs slowly	0.38
Rough broken land	19	Not rated	
YmA:			
Yomont	90	Somewhat limited	
		Occasional flooding	0.60
YtA:			
Yomont	80	Somewhat limited	
		Frequent flooding	0.80

Table 24.--Engineering Soil Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
AcA:												
Acme-------------	0-16	Loam	CL, CL-ML	A-4, A-6	0	0-2	95-100	90-100	80-95	60-85	15-30	5-12
	16-25	Silty clay loam, silt loam, loam	CL-ML, CL	A-4, A-6	0	0-2	98-100	98-100	85-100	60-90	20-35	5-15
	25-80	Gypsiferous loam, gypsiferous silt loam, gypsiferous silty clay loam	CL, CL-ML	A-4, A-6	0	0-2	98-100	98-100	85-100	60-90	20-35	5-15
AsC:												
Aspermont--------	0-6	Silty clay loam	CL	A-6, A-7-6	0	0	98-100	90-100	90-100	65-95	30-45	15-28
	6-22	Silty clay loam, silt loam, loam	CL	A-6, A-7-6	0	0	98-100	90-100	85-100	65-95	30-45	15-28
	22-45	Silty clay loam, silt loam, loam	CL	A-6, A-7-6	0	0	98-100	90-100	85-100	65-95	30-45	15-28
	45-80	Clay, silty clay, silty clay loam	CH, CL	A-7-6, A-6	0	0-2	90-100	85-100	65-100	65-96	30-60	15-38
BKF:												
Badland----------	0-40	Bedrock			---	---	---	---	---	---	---	---
Knoco------------	0-6	Clay	CH, CL	A-7-6, A-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	6-13	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	13-80	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
BmA:												
Beckman----------	0-8	Clay	CH, CL	A-7	0	0	100	100	96-100	90-95	45-60	19-34
	8-58	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	95-100	95-100	95-100	90-95	45-60	19-34
	58-77	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	95-100	95-100	95-100	90-95	45-60	19-34

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
CaA:												
Carey-----------	0-16	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	98-100	90-100	65-95	20-32	3-15
	16-37	Loam, silty clay loam, clay loam	CL, CL-ML	A-6, A-4	0	0	100	98-100	95-100	60-95	24-40	5-20
	37-66	Loam, silt loam, very fine sandy loam	CL, CL-ML, ML, SM	A-4, A-6	0	0	97-100	90-100	83-100	44-85	20-37	3-18
	66-80	Bedrock			---	---	---	---	---	---	---	---
CKF:												
Cottonwood------	0-5	Loam	CL, CL-ML	A-4, A-6	0	0	98-100	95-100	80-100	55-85	20-35	4-15
	5-12	Bedrock			---	---	---	---	---	---	---	---
	12-20	Bedrock			---	---	---	---	---	---	---	---
Knoco-----------	0-6	Clay loam	CL	A-7-6	0	0-2	95-100	95-100	90-100	50-80	40-50	18-26
	6-17	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	17-80	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
DeC:												
Delwin----------	0-17	Sand	SM	A-3, A-2	0	0	100	98-100	82-98	5-20	0-0	NP
	17-68	Sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	98-100	96-100	65-90	36-60	20-35	4-15
	68-80	Sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6, A-2-4, A-2-6	0	0	98-100	96-100	65-90	30-60	20-35	4-15
DvD:												
Devol-----------	0-17	Loamy sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-0	NP
	17-43	Sandy loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	98-100	98-100	90-100	15-60	0-26	NP-7
	43-80	Loamy sand, loamy fine sand, fine sand	SC-SM, SM	A-2, A-4	0	0	98-100	98-100	50-100	15-50	0-26	NP-7

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
EnB:												
Enterprise------	0-7	Very fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	100	98-100	95-100	65-90	20-32	3-13
	7-70	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4, A-6	0	0	98-100	98-100	95-100	65-90	20-32	3-13
	70-84	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4, A-6	0	0	98-100	98-100	95-100	65-90	20-32	3-13
EnC:												
Enterprise------	0-20	Very fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	100	98-100	95-100	65-90	20-32	3-13
	20-42	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4, A-6	0	0	98-100	98-100	95-100	65-90	20-32	3-13
	42-80	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4, A-6	0	0	98-100	98-100	95-100	65-90	20-32	3-13
FoA:												
Foursixes-------	0-4	Clay loam	CL	A-6, A-7	0	0-5	95-100	92-100	83-92	64-74	30-41	11-16
	4-17	Clay, clay loam	ML, CH, CL	A-7, A-6	0	0-5	95-100	92-100	83-100	65-95	38-52	15-23
	17-23	Clay, clay loam	ML, CH, CL	A-7, A-6	0	0-5	95-100	92-100	83-100	65-95	38-52	15-23
	23-48	Bedrock			---	---	---	---	---	---	---	---
	48-80	Bedrock			---	---	---	---	---	---	---	---
FrB:												
Frankirk--------	0-7	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0	98-100	96-100	85-95	55-75	25-39	7-19
	7-56	Clay, sandy clay, clay loam	CL	A-6, A-7-6	0	0	98-100	96-100	90-100	65-80	36-47	18-26
	56-84	Sandy clay loam, clay loam	SC, SC-SM, SM	A-2-4, A-4	0	0	90-100	90-100	75-98	30-50	17-25	3-8
GdB:												
Grandfield------	0-7	Loamy sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-14	NP
	7-32	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	32-51	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	51-80	Loamy sand, fine sandy loam	ML, SC-SM, SM	A-4, A-2	0	0	100	98-100	90-100	15-60	0-26	NP-7
GdC2:												
Grandfield, moderately eroded---------	0-3	Loamy sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-14	NP
	3-24	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	24-55	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	55-80	Fine sandy loam, loamy sand	ML, SC-SM, SM	A-4, A-2	0	0	100	98-100	90-100	15-60	0-26	NP-7
GfB:												
Grandfield------	0-8	Fine sandy loam	SM, CL-ML, ML, SC-SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	8-38	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	38-60	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	60-80	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4	0	0	100	98-100	90-100	36-60	15-30	NP-10
GfC:												
Grandfield------	0-8	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	8-39	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16
	39-62	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	15-37	NP-16

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	62-80	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4	0	0	100	98-100	90-100	36-60	15-30	NP-10
HaC:												
Hardeman--------	0-12	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0	0	100	98-100	70-96	30-60	17-25	2-7
	12-33	Fine sandy loam, very fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0	0	100	98-100	70-96	30-60	17-27	2-9
	33-80	Fine sandy loam, very fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0	0	100	98-100	70-96	30-60	17-27	2-9
JaC:												
Jaywi-----------	0-5	Silty clay loam	CL	A-6, A-4	0	0-2	96-100	96-100	90-100	65-95	25-40	8-20
	5-21	Silty clay loam, loam, clay loam	CL	A-6, A-4	0	0-2	96-100	96-100	85-100	55-95	25-40	8-20
	21-80	Silty clay loam, loam, clay loam	CL	A-6, A-4	0	0-2	90-100	85-100	85-98	55-95	25-40	8-20
JeE:												
Jester----------	0-11	Loamy sand	SC-SM, SM, SP-SM	A-2-4	0	0-2	90-100	90-100	75-95	10-30	0-25	NP-6
	11-80	Loamy sand, loamy fine sand, fine sand	SC-SM, SM, SP-SM	A-2-4	0	0-2	90-100	90-100	75-95	10-30	0-25	NP-6
KgA:												
Kingco----------	0-12	Silty clay loam, silty clay	CL	A-6, A-7-6	0	0	100	95-100	90-100	75-95	35-50	17-30
	12-51	Silty clay, clay	CH, CL	A-7-6	0	0	98-100	96-100	90-100	75-96	41-60	20-35
	51-82	Silty clay loam, clay loam, clay	CH, CL	A-7-6	0	0	98-100	96-100	85-99	75-95	41-55	20-32

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
KVD:												
Knoco-----------	0-7	Clay	CH, CL	A-7-6, A-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	7-16	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	16-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
Vernon----------	0-4	Clay loam	CL	A-6, A-7-6	0	0	95-100	90-100	90-100	70-95	35-50	17-30
	4-10	Clay, silty clay	CH, CL	A-7-6, A-6	0	0	95-100	90-100	90-100	80-98	38-60	20-40
	10-23	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-5	90-100	85-100	65-100	65-96	30-60	15-38
	23-29	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-5	90-100	85-100	65-100	65-96	30-60	15-38
	29-80	Clay, silty clay	CH, CL	A-7-6, A-6	0	0-5	90-100	85-100	65-100	65-96	30-60	15-38
LaA:												
Lazare----------	0-12	Clay	CH	A-7-6	0	0	100	100	95-100	85-98	55-76	33-50
	12-69	Clay, silty clay	CH	A-7-6	0	0	100	98-100	90-100	80-95	55-76	33-50
	69-90	Silty clay, clay	CH	A-7-6	0	0	100	98-100	90-100	80-95	55-76	33-50
LnA:												
Lincoln---------	0-6	Loamy sand	SM	A-2	0	0	95-100	85-100	75-100	15-35	0-14	NP
	6-80	Sand, stratified fine sand to clay loam	SM, SP-SM	A-2, A-3	0	0	95-100	85-100	82-100	5-35	0-34	NP-10
M-W:												
Water, miscellaneous--	---	---	---	---	---	---	---	---	---	---	---	---
MfA:												
Miles-----------	0-14	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0	0	98-100	96-100	85-98	25-55	16-22	2-7
	14-19	Sandy clay loam, clay loam, loam	CL, CL-ML, SC, SC-SM	A-2-4, A-2-6, A-4, A-6	0	0	98-100	96-100	85-98	30-72	20-40	4-20
	19-49	Sandy clay loam, clay loam, loam	CL, CL-ML, SC, SC-SM	A-2-6, A-2-4, A-4, A-6	0	0	98-100	96-100	85-98	30-72	20-40	4-20

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	49-80	Sandy clay loam, clay loam, loam	CL, CL-ML, SC, SC-SM	A-2-6, A-2-4, A-4, A-6	0	0	90-100	90-100	80-100	30-72	20-36	4-18
NoC: Nobscot---------	0-29	Sand	SM	A-2, A-3	0	0	100	95-100	82-98	5-25	0-0	NP
	29-43	Sandy loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	95-100	90-100	36-60	15-26	NP-7
	43-90	Loamy sand, fine sand, loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	0-14	NP
NpB: Nipsum----------	0-29	Silty clay	CL	A-7-6	0	0-2	98-100	90-100	90-100	80-95	40-50	20-30
	29-80	Clay, silty clay, silty clay loam	CL	A-7-6	0	0	98-100	90-100	90-100	80-100	40-50	20-30
ObC: Obaro-----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	90-98	65-90	25-40	7-20
	7-23	Silty clay loam			0	0	100	100	94-100	90-100	33-48	17-28
	23-38	Silty clay loam			0	0	100	100	94-100	90-100	33-48	17-28
	38-43	Bedrock			---	---	---	---	---	---	---	---
PdB: Paducah---------	0-8	Loam	CL, CL-ML, ML	A-4	0	0	99-100	98-100	90-100	51-80	18-28	3-10
	8-13	Loam	CL, CL-ML, ML	A-4	0	0	99-100	98-100	90-100	51-80	18-28	3-10
	13-39	Clay loam, loam, silty clay loam	CL	A-6	0	0	99-100	98-100	95-100	51-80	25-40	11-23
	39-62	Loam, very fine sandy loam, silt loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	95-100	90-100	85-100	36-65	20-35	5-16
	62-80	Very fine sandy loam, silt loam			0	0	95-100	90-100	85-100	36-65	20-35	5-16
QnB: Quanah----------	0-18	Silty clay loam	CL	A-4, A-6	0	0	96-100	96-100	90-100	65-95	25-40	8-20
	18-34	Silty clay loam	CL	A-4, A-6	0	0	96-100	96-100	90-100	65-95	25-40	8-20

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	34-50	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	96-100	96-100	85-100	55-95	25-40	8-20
	50-80	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	90-100	85-100	85-98	55-95	25-40	8-20
QTD:												
Quanah----------	0-10	Silty clay loam	CL	A-4, A-6	0	0	96-100	96-100	90-100	65-95	25-40	8-20
	10-25	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	96-100	96-100	85-100	55-95	25-40	8-20
	25-80	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	90-100	85-100	85-98	55-95	25-40	8-20
Talpa-----------	0-8	Gravelly loam	CL	A-6, A-4	0-2	0-5	70-95	65-90	60-85	50-80	25-40	8-21
	8-20	Bedrock			---	---	---	---	---	---	---	---
	20-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
QUG:												
Quinlan---------	0-4	Very fine sandy loam	ML, CL, CL-ML	A-4, A-6	0	0	100	98-100	95-100	65-90	15-26	3-13
	4-11	Very fine sandy loam, loam, silt loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	51-98	15-37	6-14
	11-16	Very fine sandy loam, loam, silt loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	51-98	15-37	6-14
	16-35	Bedrock			---	---	---	---	---	---	---	---
Rock outcrop----	0-40	Bedrock			---	---	---	---	---	---	---	---
RCG:												
Rock outcrop----	0-80	Bedrock			---	---	---	---	---	---	---	---
Cottonwood------	0-9	Loam	CL, CL-ML	A-4, A-6	0	0	98-100	95-100	80-100	55-85	20-35	4-15
	9-20	Bedrock			---	---	---	---	---	---	---	---
ShB:												
Shrewder--------	0-14	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	98-100	94-100	51-75	14-28	NP-7

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	14-55	Very fine sandy loam, loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	15-29	NP-7
	55-65	Very fine sandy loam, fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	15-85	15-29	NP-7
	65-80	Bedrock			---	---	---	---	---	---	---	---
ShC:												
Shrewder--------	0-16	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	98-100	94-100	51-75	14-28	NP-7
	16-51	Very fine sandy loam, loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	15-29	NP-7
	51-60	Very fine sandy loam, fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	15-85	15-29	NP-7
	60-80	Bedrock			---	---	---	---	---	---	---	---
SpA:												
St. Paul--------	0-18	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	95-100	65-98	22-35	2-13
	18-24	Silt loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	95-100	75-98	30-43	8-18
	24-32	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	95-100	80-98	33-43	12-20
	32-46	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	95-100	80-98	33-50	12-26
	46-63	Loam, silt loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	95-100	75-98	27-50	8-26
	63-80	Loam, silt loam, silty clay loam	CL	A-4, A-6	0	0	100	100	95-100	75-98	27-40	8-18

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
TaC:												
Talpa-----------	0-9	Gravelly loam	CL	A-6, A-4	0-2	0-5	70-95	65-90	60-88	50-80	25-40	8-20
	9-53	Bedrock			---	---	---	---	---	---	---	---
	53-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
TKG:												
Talpa-----------	0-9	Gravelly loam	CL	A-6, A-4	0-2	0-5	70-95	65-90	60-88	50-80	25-40	8-21
	9-16	Bedrock			---	---	---	---	---	---	---	---
	16-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
Knoco-----------	0-5	Bouldery clay	CH, CL	A-6, A-7-6	2-5	5-10	90-100	85-100	85-100	80-98	30-60	12-38
	5-14	Clay, silty clay	CH, CL	A-6, A-7-6	0	0-2	90-100	80-100	75-100	60-90	30-60	12-38
	14-80	Clay, silty clay	CH, CL	A-6, A-7-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
Rock outcrop----	0-80	Bedrock			---	---	---	---	---	---	---	---
TQB:												
Talpa-----------	0-14	Gravelly clay loam	CL	A-7, A-6	0-2	0-5	70-95	65-90	60-88	50-80	30-45	11-25
	14-20	Bedrock			---	---	---	---	---	---	---	---
	20-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	0-2	90-100	85-100	70-100	70-100	30-60	12-38
Quanah----------	0-10	Silty clay loam	CL	A-4, A-6	0	0	96-100	96-100	90-100	65-95	25-40	8-20
	10-15	Silty clay loam	CL	A-4, A-6	0	0	96-100	96-100	90-100	65-95	25-40	8-20
	15-55	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	96-100	96-100	85-100	55-95	25-40	8-20
	55-80	Silty clay loam, clay loam, loam	CL	A-4, A-6	0	0	90-100	85-100	85-98	55-95	25-40	8-20
TvB:												
Tilvern---------	0-5	Clay loam	CL	A-6, A-7-6	0	0-3	95-100	90-100	90-100	70-95	35-50	17-30
	5-12	Clay, silty clay, clay loam	CH, CL	A-6, A-7-6	0	0-3	95-100	90-100	90-100	70-97	35-60	17-40
	12-46	Clay, silty clay	CH, CL	A-6, A-7-6	0	0-3	95-100	90-100	90-100	70-97	38-60	20-40

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	46-53	Clay, silty clay	CH, CL	A-6, A-7-6	0	0-3	95-100	90-100	90-100	70-97	38-60	20-40
	53-80	Clay, silty clay	CH, CL	A-6, A-7-6	0	0-3	90-100	85-100	65-100	65-95	30-60	15-40
W:												
Water-----------	---	---	---	---	---	---	---	---	---	---	---	---
WcA:												
Westill---------	0-10	Clay loam	CL	A-6	0	0	100	100	98-100	70-90	25-40	11-23
	10-15	Clay, clay loam	CH, CL	A-6, A-7-6	0	0	98-100	93-100	90-98	70-95	38-60	20-38
	15-22	Clay, clay loam	CH, CL	A-6, A-7-6	0	0	98-100	93-100	90-98	70-95	38-60	20-38
	22-58	Clay, clay loam	CH, CL	A-6, A-7-6	0	0-5	95-100	90-100	80-97	60-90	28-55	13-35
	58-80	Clay, clay loam	CH, CL	A-6, A-7-6	0	0-5	95-100	90-100	80-97	60-90	28-55	13-35
WeA:												
Westola---------	0-5	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	95-100	90-100	36-60	15-26	NP-7
	5-41	Stratified fine sandy loam to very fine sandy loam, loam, very fine sandy loam	CL, ML, SC, SM	A-4	0	0	100	95-100	90-100	36-85	15-30	NP-10
	41-80	Stratified loamy fine sand to fine sandy loam to loam	CL, ML, SC, SM	A-2, A-4	0	0	100	95-100	90-100	15-85	15-30	NP-10
WfA:												
Westola---------	0-4	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	95-100	90-100	36-60	15-26	NP-7
	4-14	Stratified loamy sand to fine sandy loam to loam, loam, very fine sandy loam	CL, ML, SC, SM	A-4	0	0	100	95-100	90-100	36-85	15-30	NP-10

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
	14-80	Stratified loamy fine sand to fine sandy loam to loam	CL, ML, SC, SM	A-2, A-4	0	0	100	95-100	90-100	15-85	15-30	NP-10
WhA:												
Wheatwood-------	0-4	Loam	CL, CL-ML	A-4, A-6	0	0	100	98-100	85-100	60-90	20-35	4-17
	4-44	Loam, silty clay loam			0	0	100	100	94-100	73-85	26-41	9-19
	44-80	Stratified silty clay loam to very fine sandy loam to loam, silt loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	100	98-100	95-100	65-95	20-40	4-20
WoC:												
Woodward--------	0-8	Loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	65-97	22-31	2-10
	8-38	Loam, silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	38-72	Bedrock			---	---	---	---	---	---	---	---
WoD:												
Woodward--------	0-12	Loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	65-97	22-31	2-10
	12-34	Loam, silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	34-80	Bedrock			---	---	---	---	---	---	---	---
WQF:												
Woodward--------	0-7	Loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	65-97	22-31	2-10
	7-28	Loam, silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	28-80	Bedrock			---	---	---	---	---	---	---	---

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
Quinlan---------	0-5	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	51-97	22-35	6-14
	5-11	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	51-97	22-35	6-14
	11-16	Loam, silt loam, very fine sandy loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	51-98	15-37	6-14
	16-80	Bedrock			---	---	---	---	---	---	---	---
WQG:												
Woodward--------	0-9	Loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	65-97	22-31	2-10
	9-29	Loam, silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	29-80	Bedrock			---	---	---	---	---	---	---	---
Quinlan---------	0-4	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	51-97	22-35	6-14
	4-14	Loam, silt loam, very fine sandy loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	51-98	15-37	6-14
	14-80	Bedrock			---	---	---	---	---	---	---	---
Rough broken land-----------	0-40	Bedrock	CL-ML, ML, SC-SM, SM	A-2-4, A-2-6, A-4	0-5	0-5	95-100	90-100	75-95	25-55	16-30	3-11
YmA:												
Yomont----------	0-8	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	98-100	85-98	51-75	16-30	NP-7
	8-80	Stratified very fine sandy loam to fine sandy loam to loamy very fine sand to silt loam, loam, silt loam	CL-ML, ML	A-4	0	0	100	98-100	85-100	55-85	16-30	NP-7

Table 24.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
YtA:												
Yomont----------	0-10	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	98-100	85-98	51-75	16-30	NP-7
	10-80	Stratified very fine sandy loam to silt loam, loam, silt loam	CL-ML, ML	A-4	0	0	100	98-100	85-100	55-85	16-30	NP-7

Table 25.--Physical Soil Properties

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
AcA:														
Acme-----------------	0-16	---	---	15-27	1.30-1.50	0.6-2	0.15-0.22	0.0-2.9	1.0-2.0	.37	.37	2	4L	86
	16-25	---	---	18-30	1.30-1.45	0.6-2	0.15-0.22	3.0-5.9	0.0-0.5	.37	.37			
	25-80	---	---	18-30	1.40-1.60	2-6	0.05-0.14	0.0-2.9	0.0-0.5	.37	.37			
AsC:														
Aspermont-----------	0-6	---	---	27-35	1.40-1.55	0.6-2	0.12-0.18	3.0-5.9	0.5-2.0	.37	.37	4	4L	86
	6-22	---	---	18-33	1.40-1.60	0.6-2	0.12-0.18	3.0-5.9	0.0-0.5	.37	.37			
	22-45	---	---	18-33	1.45-1.65	0.6-2	0.10-0.18	3.0-5.9	0.0-0.5	.37	.37			
	45-80	---	---	35-60	1.60-1.75	0.00-0.06	0.06-0.10	6.0-8.9	0.0-0.5	.37	.37			
BKF:														
Badland-------------	0-40	---	---	35-60	1.30-1.80	0.06-0.2	0.07-0.10	---	---	.43	.43	2	4	86
Knoco---------------	0-6	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32	1	4	86
	6-13	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32			
	13-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
BmA:														
Beckman-------------	0-8	---	---	35-60	1.25-1.45	0.00-0.06	0.12-0.18	6.0-8.9	0.5-3.0	.32	.32	5	4	86
	8-58	---	---	35-60	1.35-1.60	0.00-0.06	0.08-0.12	6.0-8.9	0.0-1.0	.37	.37			
	58-77	---	---	35-60	1.35-1.60	0.00-0.06	0.08-0.12	6.0-8.9	0.0-1.0	.37	.37			
CaA:														
Carey---------------	0-16	---	---	10-25	1.35-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	16-37	---	---	20-35	1.40-1.60	0.6-2	0.15-0.20	0.0-2.9	0.1-0.5	.37	.37			
	37-66	---	---	15-27	1.40-1.60	0.6-2	0.10-0.18	0.0-2.9	0.1-0.5	.37	.37			
	66-80	---	---	---	---	0.2-0.6	---	---	---	---	---			
CKF:														
Cottonwood----------	0-5	---	---	18-27	1.30-1.50	0.6-2	0.11-0.18	0.0-2.9	0.5-1.0	.32	.32	1	4L	86
	5-12	---	---	---	---	0.2-20	---	---	---	---	---			
	12-20	---	---	---	---	0.2-20	---	---	---	---	---			
Knoco---------------	0-6	---	---	35-40	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.37	.37	1	4L	86
	6-17	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32			
	17-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
DeC:														
Delwin---------------	0-17	---	---	3-10	1.50-1.65	6-20	0.02-0.06	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	17-68	---	---	18-35	1.50-1.65	0.6-2	0.12-0.16	0.0-2.9	0.5-1.0	.24	.24			
	68-80	---	---	15-30	1.55-1.70	0.6-2	0.10-0.14	0.0-2.9	0.5-1.0	.24	.24			
DvD:														
Devol----------------	0-17	---	---	2-8	1.35-1.50	2-6	0.07-0.11	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	17-43	---	---	2-18	1.50-1.70	2-6	0.07-0.15	0.0-2.9	0.0-0.5	.20	.20			
	43-80	---	---	2-10	1.50-1.70	2-6	0.08-0.12	0.0-2.9	0.0-0.5	.17	.17			
EnB:														
Enterprise-----------	0-7	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.5-1.0	.43	.43	5	3	86
	7-70	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.1-0.5	.43	.43			
	70-84	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.1-0.5	.43	.43			
EnC:														
Enterprise-----------	0-20	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.5-1.0	.43	.43	5	3	86
	20-42	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.1-0.5	.43	.43			
	42-80	---	---	7-18	1.35-1.55	2-6	0.15-0.20	0.0-2.9	0.1-0.5	.43	.43			
FoA:														
Foursixes------------	0-4	---	---	27-35	1.35-1.60	0.6-2	0.15-0.20	0.0-2.9	0.5-2.0	.32	.32	2	6	48
	4-17	---	---	35-50	1.35-1.60	0.06-0.2	0.12-0.20	3.0-5.9	0.1-0.5	.32	.32			
	17-23	---	---	35-50	1.35-1.60	0.06-0.2	0.12-0.20	3.0-5.9	0.1-0.5	.32	.32			
	23-48	---	---	---	---	0.06-2	---	---	---	---	---			
	48-80	---	---	---	---	0.2-0.6	---	---	---	---	---			
FrB:														
Frankirk-------------	0-7	---	---	26-35	1.40-1.55	0.6-2	0.14-0.18	3.0-5.9	1.0-3.0	.32	.32	5	6	48
	7-56	---	---	35-45	1.45-1.60	0.2-0.6	0.15-0.20	3.0-5.9	0.5-2.0	.37	.37			
	56-84	---	---	20-30	1.30-1.50	2-6	0.10-0.15	0.0-2.9	0.5-2.0	.24	.24			
GdB:														
Grandfield-----------	0-7	---	---	5-10	1.35-1.50	2-6	0.07-0.11	0.0-2.9	0.5-1.0	.20	.20	5	2	134
	7-32	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	32-51	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	51-80	---	---	2-18	1.50-1.70	2-6	0.07-0.15	0.0-2.9	0.0-0.5	.20	.20			
GdC2:														
Grandfield, moderately eroded--	0-3	---	---	5-10	1.35-1.50	2-6	0.07-0.11	0.0-2.9	0.5-1.0	.20	.20	5	2	134
	3-24	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	24-55	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	55-80	---	---	2-18	1.50-1.70	2-6	0.07-0.15	0.0-2.9	0.0-0.5	.20	.20			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
GfB:														
Grandfield----------	0-8	---	---	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	8-38	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	38-60	---	---	14-24	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	60-80	---	---	10-25	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.0-0.5	.28	.28			
GfC:														
Grandfield----------	0-8	---	---	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	8-39	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	39-62	---	---	18-30	1.50-1.70	0.6-2	0.11-0.17	0.0-2.9	0.3-0.7	.32	.32			
	62-80	---	---	10-25	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.0-0.5	.28	.28			
HaC:														
Hardeman------------	0-12	---	---	10-18	1.35-1.55	2-6	0.10-0.15	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	12-33	---	---	12-18	1.35-1.55	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.28	.28			
	33-80	---	---	12-18	1.35-1.55	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.28	.28			
JaC:														
Jaywi---------------	0-5	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	0.5-2.0	.37	.37	5	4L	86
	5-21	---	---	18-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	21-80	---	---	18-35	1.30-1.50	0.6-2	0.12-0.18	0.0-2.9	0.0-0.5	.37	.37			
JeE:														
Jester--------------	0-11	---	---	5-15	1.50-1.65	6-20	0.04-0.08	0.0-2.9	0.1-1.0	.15	.15	5	2	134
	11-80	---	---	5-15	1.50-1.70	6-20	0.02-0.08	0.0-2.9	0.1-0.5	.15	.15			
KgA:														
Kingco--------------	0-12	---	---	27-40	1.30-1.55	0.2-0.6	0.15-0.20	6.0-8.9	1.0-3.0	.32	.32	5	6	48
	12-51	---	---	40-55	1.35-1.60	0.06-0.2	0.12-0.18	6.0-8.9	1.0-2.0	.32	.32			
	51-82	---	---	27-50	1.35-1.60	0.06-0.2	0.11-0.17	6.0-8.9	0.0-0.5	.32	.32			
KVD:														
Knoco---------------	0-7	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32	1	4	86
	7-16	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32			
	16-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
Vernon--------------	0-4	---	---	35-40	1.35-1.55	0.00-0.06	0.12-0.17	6.0-8.9	0.5-2.0	.37	.37	3	4	86
	4-10	---	---	40-60	1.50-1.65	0.00-0.06	0.10-0.15	6.0-8.9	0.1-1.0	.37	.37			
	10-23	---	---	40-60	1.60-1.75	0.00-0.06	0.06-0.10	6.0-8.9	0.1-1.0	.37	.37			
	23-29	---	---	40-60	1.60-1.75	0.00-0.06	0.06-0.10	6.0-8.9	0.1-1.0	.37	.37			
	29-80	---	---	40-60	1.70-2.00	0.00-0.06	0.01-0.06	6.0-8.9	0.1-1.0	.32	.32			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
LaA:														
Lazare---------------	0-12	0-20	40-60	40-60	1.25-1.45	0.00-0.06	0.12-0.18	6.0-15.0	0.5-2.0	.37	.37	5	4	86
	12-69	0-45	0-60	40-60	1.30-1.60	0.00-0.06	0.12-0.18	6.0-15.0	0.1-1.0	.37	.37			
	69-90	0-45	0-60	40-60	1.30-1.60	0.00-0.06	0.12-0.18	6.0-15.0	0.1-1.0	.37	.37			
LnA:														
Lincoln--------------	0-6	---	---	5-15	1.35-1.50	6-20	0.06-0.11	0.0-2.9	0.0-0.5	.17	.17	5	1	134
	6-80	---	---	5-28	1.30-1.60	6-20	0.02-0.08	0.0-2.9	0.0-0.5	.17	.17			
M-W:														
Water, miscellaneous	---	---	---	---	---	---	---	---	---	---	---	-	---	---
MfA:														
Miles----------------	0-14	---	---	7-18	1.40-1.60	2-6	0.10-0.15	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	14-19	---	---	20-35	1.50-1.65	0.6-2	0.12-0.18	0.0-2.9	0.0-0.5	.32	.32			
	19-49	---	---	20-35	1.50-1.65	0.6-2	0.12-0.18	0.0-2.9	0.0-0.5	.32	.32			
	49-80	---	---	20-35	1.50-1.65	0.6-2	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
NoC:														
Nobscot--------------	0-29	---	---	2-8	1.35-1.50	2-6	0.05-0.08	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	29-43	---	---	8-15	1.50-1.70	2-6	0.10-0.15	0.0-2.9	0.0-0.5	.20	.20			
	43-90	---	---	2-10	1.60-1.70	2-6	0.05-0.11	0.0-2.9	0.0-0.5	.17	.17			
NpB:														
Nipsum---------------	0-29	---	---	40-45	1.25-1.45	0.06-0.2	0.13-0.17	3.0-5.9	1.0-3.0	.32	.32	5	4	86
	29-80	---	---	35-55	1.25-1.45	0.06-0.2	0.10-0.16	3.0-5.9	0.5-2.0	.32	.32			
ObC:														
Obaro----------------	0-7	---	---	18-27	1.25-1.40	0.6-2	0.12-0.16	0.0-2.9	0.1-1.0	.43	.43	3	4L	86
	7-23	---	---	18-40	1.25-1.40	0.6-2	0.12-0.17	---	0.1-1.0	.32	.32			
	23-38	---	---	18-40	1.25-1.40	0.6-2	0.12-0.17	---	0.1-1.0	.32	.32			
	38-43	---	---	---	1.70-2.20	0.2-0.6	---	---	---	---	---			
PdB:														
Paducah--------------	0-8	---	---	8-27	1.30-1.45	0.6-2	0.16-0.20	0.0-2.9	0.5-1.0	.43	.43	5	5	56
	8-13	---	---	8-27	1.30-1.45	0.6-2	0.16-0.20	0.0-2.9	0.5-1.0	.43	.43			
	13-39	---	---	18-35	1.30-1.45	0.6-2	0.15-0.20	0.0-2.9	0.1-0.5	.37	.37			
	39-62	---	---	10-27	1.40-1.65	0.6-2	0.10-0.18	0.0-2.9	0.1-0.5	.37	.37			
	62-80	---	---	10-27	1.70-2.25	0.2-0.6	---	0.0-2.9	0.0-0.1	.37	.37			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
QnB:														
Quanah---------------	0-18	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	4L	86
	18-34	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37			
	34-50	---	---	20-40	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	50-80	---	---	20-40	1.35-1.55	0.6-2	0.10-0.16	0.0-2.9	0.1-0.5	.37	.37			
QTD:														
Quanah---------------	0-10	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	4L	86
	10-25	---	---	20-40	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	25-80	---	---	20-40	1.35-1.55	0.6-2	0.10-0.16	0.0-2.9	0.1-0.5	.37	.37			
Talpa----------------	0-8	---	---	22-35	1.30-1.45	0.6-2	0.10-0.14	0.0-2.9	1.0-3.0	.17	.32	1	5	56
	8-20	---	---	---	---	0.06-2	---	---	---	---	---			
	20-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
QUG:														
Quinlan--------------	0-4	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37	2	3	86
	4-11	---	---	10-27	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
	11-16	---	---	10-27	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
	16-35	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
Rock outcrop---------	0-40	---	---	---	---	0.06-20	---	---	---	---	---	-	---	---
RCG:														
Rock outcrop---------	0-80	---	---	---	---	0.06-20	---	---	---	---	---	-	---	---
Cottonwood-----------	0-9	---	---	18-27	1.30-1.50	0.6-2	0.11-0.18	0.0-2.9	0.5-1.0	.32	.32	1	4L	86
	9-20	---	---	---	---	0.2-20	---	---	---	---	---			
ShB:														
Shrewder-------------	0-14	---	---	10-18	1.30-1.60	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32	5	3	86
	14-55	---	---	10-18	1.40-1.70	2-6	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	55-65	---	---	10-18	1.40-1.70	2-6	0.07-0.20	0.0-2.9	0.0-0.5	.32	.32			
	65-80	---	---	---	1.85-2.35	0.2-0.6	---	---	---	---	---			
ShC:														
Shrewder-------------	0-16	---	---	10-18	1.30-1.60	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32	5	3	86
	16-51	---	---	10-18	1.40-1.70	2-6	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	51-60	---	---	10-18	1.40-1.70	2-6	0.07-0.20	0.0-2.9	0.0-0.5	.32	.32			
	60-80	---	---	---	1.85-2.35	0.2-0.6	---	---	---	---	---			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
SpA:														
St. Paul------------	0-18	---	---	15-27	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	18-24	---	---	18-35	1.40-1.70	0.6-2	0.15-0.22	0.0-2.9	1.0-3.0	.37	.37			
	24-32	---	---	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	1.0-3.0	.32	.32			
	32-46	---	---	27-40	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-2.0	.32	.32			
	46-63	---	---	20-40	1.40-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.0-1.0	.37	.37			
	63-80	---	---	15-35	1.40-1.70	0.2-2	0.15-0.22	3.0-5.9	0.0-1.0	.37	.37			
TaC:														
Talpa----------------	0-9	---	---	22-35	1.30-1.45	0.6-2	0.10-0.14	0.0-2.9	1.0-3.0	.17	.32	1	5	56
	9-53	---	---	---	---	0.06-2	---	---	---	---	---			
	53-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
TKG:														
Talpa----------------	0-9	---	---	22-35	1.30-1.45	0.6-2	0.10-0.14	0.0-2.9	1.0-3.0	.17	.32	1	5	56
	9-16	---	---	---	---	0.06-2	---	---	---	---	---			
	16-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
Knoco----------------	0-5	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.17	.32	1	5	56
	5-14	---	---	40-60	1.25-1.45	0.00-0.06	0.10-0.17	1.0-4.0	0.5-1.0	.32	.32			
	14-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
Rock outcrop---------	0-80	---	---	---	---	0.06-20	---	---	---	---	---	-	---	---
TQB:														
Talpa----------------	0-14	---	---	22-35	1.30-1.45	0.6-2	0.10-0.14	0.0-2.9	1.0-3.0	.17	.32	1	5	56
	14-20	---	---	---	---	0.06-2	---	---	---	---	---			
	20-80	---	---	40-60	1.70-2.25	0.00-0.06	0.01-0.03	1.0-4.0	0.0-0.3	.32	.32			
Quanah--------------	0-10	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	4L	86
	10-15	---	---	27-35	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37			
	15-55	---	---	20-40	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	55-80	---	---	20-40	1.35-1.55	0.6-2	0.10-0.16	0.0-2.9	0.1-0.5	.37	.37			
TvB:														
Tilvern--------------	0-5	---	---	35-40	1.30-1.50	0.00-0.06	0.15-0.20	6.0-8.9	0.5-2.0	.32	.32	4	4	86
	5-12	---	---	35-55	1.30-1.53	0.00-0.06	0.12-0.18	6.0-8.9	0.5-1.0	.37	.37			
	12-46	---	---	40-55	1.50-1.65	0.00-0.06	0.10-0.17	6.0-8.9	0.0-0.5	.37	.37			
	46-53	---	---	40-55	1.50-1.65	0.00-0.06	0.10-0.17	6.0-8.9	0.0-0.5	.37	.37			
	53-80	---	---	40-55	1.60-1.75	0.00-0.06	0.06-0.10	6.0-8.9	0.0-0.5	.32	.32			
W:														
Water----------------	---	---	---	---	---	---	---	---	---	---	---	-	---	---

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
WcA:														
Westill--------------	0-10	---	---	27-35	1.30-1.45	0.2-0.6	0.12-0.18	3.0-5.9	1.0-3.0	.32	.32	5	6	48
	10-15	---	---	35-50	1.45-1.65	0.00-0.06	0.12-0.18	6.0-8.9	1.0-2.0	.32	.32			
	15-22	---	---	35-50	1.45-1.65	0.00-0.06	0.12-0.18	6.0-8.9	0.1-0.5	.32	.32			
	22-58	---	---	35-50	1.45-1.70	0.00-0.06	0.11-0.17	6.0-8.9	0.1-0.5	.32	.32			
	58-80	---	---	35-45	1.45-1.90	0.00-0.06	0.02-0.09	6.0-8.9	0.1-0.5	.32	.32			
WeA:														
Westola--------------	0-5	---	---	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	5-41	---	---	5-18	1.40-1.70	2-6	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	41-80	---	---	5-18	1.40-1.70	2-6	0.07-0.20	0.0-2.9	0.0-0.5	.32	.32			
WfA:														
Westola--------------	0-4	---	---	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	4-14	---	---	5-18	1.40-1.70	2-6	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	14-80	---	---	5-18	1.40-1.70	2-6	0.07-0.20	0.0-2.9	0.0-0.5	.32	.32			
WhA:														
Wheatwood-----------	0-4	---	---	15-27	1.40-1.60	0.6-2	0.16-0.22	0.0-2.9	0.5-2.0	.43	.43	5	6	48
	4-44	---	---	15-27	1.40-1.60	0.6-2	0.16-0.22	0.0-2.9	0.5-2.0	.43	.43			
	44-80	---	---	18-35	1.40-1.65	0.6-2	0.16-0.22	0.0-2.9	0.5-2.0	.43	.43			
WoC:														
Woodward------------	0-8	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37	3	5	56
	8-38	---	---	10-18	1.40-1.65	0.6-2	0.13-0.24	0.0-2.9	0.0-0.5	.37	.37			
	38-72	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
WoD:														
Woodward------------	0-12	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37	3	5	56
	12-34	---	---	10-18	1.40-1.65	0.6-2	0.13-0.24	0.0-2.9	0.0-0.5	.37	.37			
	34-80	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
WQF:														
Woodward------------	0-7	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37	3	5	56
	7-28	---	---	10-18	1.40-1.65	0.6-2	0.13-0.24	0.0-2.9	0.0-0.5	.37	.37			
	28-80	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
Quinlan--------------	0-5	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37	2	5	56
	5-11	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
	11-16	---	---	10-27	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
	16-80	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			

Table 25.--Physical Soil Properties--Continued

Map symbol and soil name	Particle size				Moist bulk density	Permeability	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
	Depth	Sand	Silt	Clay						Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
WQG:														
Woodward------------	0-9	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37	3	5	56
	9-29	---	---	10-18	1.40-1.65	0.6-2	0.13-0.24	0.0-2.9	0.0-0.5	.37	.37			
	29-80	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
Quinlan-------------	0-4	---	---	10-18	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37	2	5	56
	4-14	---	---	10-27	1.30-1.60	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
	14-80	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
Rough broken land---	0-40	---	---	10-27	1.25-1.50	2-6	0.10-0.14	0.0-2.9	0.1-1.0	.24	.24	5	3	86
YmA:														
Yomont--------------	0-8	---	---	10-18	1.30-1.55	2-6	0.14-0.18	0.0-2.9	0.5-1.0	.49	.49	5	3	86
	8-80	---	---	10-18	1.40-1.60	2-6	0.14-0.20	0.0-2.9	0.1-0.5	.49	.49			
YtA:														
Yomont--------------	0-10	---	---	10-18	1.30-1.55	2-6	0.14-0.18	0.0-2.9	0.5-1.0	.49	.49	5	3	86
	10-80	---	---	10-18	1.40-1.60	2-6	0.14-0.20	0.0-2.9	0.1-0.5	.49	.49			

Table 26.--Chemical Soil Properties

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
AcA:							
Acme------------------	0-16	10-25	7.4-8.4	1-15	0-3	0.0-2.0	0-2
	16-25	10-25	7.9-8.4	1-5	0-3	0.0-2.0	0-8
	25-80	5.0-15	7.9-8.4	5-25	20-80	2.0-8.0	0-13
AsC:							
Aspermont------------	0-6	15-25	7.9-8.4	2-10	0	0	0
	6-22	15-25	7.9-8.4	5-15	0	0	0
	22-45	15-25	7.9-8.4	10-40	0	0	0
	45-80	20-35	7.9-8.4	5-15	0-2	2.0-8.0	5-15
BKF:							
Badland--------------	0-40	---	7.9-8.4	2-10	0-5	2.0-8.0	2-20
Knoco----------------	0-6	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	6-13	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	13-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
BmA:							
Beckman--------------	0-8	24-35	7.9-8.4	1-5	0-5	0.0-8.0	0-4
	8-58	24-35	7.9-8.4	5-15	2-25	4.0-16.0	2-8
	58-77	24-35	7.9-8.4	5-15	2-25	4.0-16.0	2-8
CaA:							
Carey----------------	0-16	5.0-12	6.6-7.8	0	0	0.0-2.0	0
	16-37	10-18	6.6-8.4	2-20	0	0.0-2.0	0
	37-66	8.0-15	7.9-8.4	5-15	0	0.0-2.0	0
	66-80	---	---	---	---	---	---
CKF:							
Cottonwood-----------	0-5	10-15	7.9-8.4	5-30	5-40	0	0
	5-12	---	---	---	---	---	---
	12-20	---	---	---	---	---	---
Knoco----------------	0-6	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	6-17	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	17-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
DeC:							
Delwin---------------	0-17	2.0-5.0	6.1-7.3	0	0	0	0
	17-68	10-20	6.6-7.8	0-5	0	0	0
	68-80	10-20	6.6-8.4	0-5	0	0	0
DvD:							
Devol----------------	0-17	2.0-8.0	6.1-7.8	0	0	0	0
	17-43	2.0-11	6.6-7.8	0	0	0	0
	43-80	2.0-6.0	6.6-8.4	0-1	0	0	0
EnB:							
Enterprise-----------	0-7	5.0-12	7.4-8.4	0-5	0	0.0-2.0	0
	7-70	5.0-10	7.4-8.4	3-10	0	0.0-2.0	0
	70-84	5.0-10	7.4-8.4	3-10	0	0.0-2.0	0
EnC:							
Enterprise-----------	0-20	5.0-12	7.4-8.4	0-5	0	0.0-2.0	0
	20-42	5.0-10	7.4-8.4	3-10	0	0.0-2.0	0
	42-80	5.0-10	7.4-8.4	3-10	0	0.0-2.0	0

Table 26.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
FoA:							
Foursixes	0-4	10-25	6.6-7.8	0	0	0.0-2.0	0
	4-17	20-35	6.6-8.4	0-5	0	0.0-2.0	0
	17-23	20-35	6.6-8.4	5-10	0	0.0-2.0	0
	23-48	---	---	---	---	---	---
	48-80	---	---	---	---	---	---
FrB:							
Frankirk	0-7	13-18	6.6-7.8	0	0	0.0-2.0	0
	7-56	18-23	6.6-8.4	0-5	0	0.0-2.0	0
	56-84	5.0-20	6.1-7.3	0	0	0.0-2.0	0
GdB:							
Grandfield	0-7	6.0-9.0	6.1-7.8	0	0	0	0
	7-32	14-21	6.1-7.8	0	0	0	0
	32-51	14-21	6.6-8.4	0	0	0	0
	51-80	12-18	6.6-8.4	0-5	0	0	0
GdC2:							
Grandfield, moderately eroded	0-3	6.0-9.0	6.1-7.8	0	0	0	0
	3-24	14-21	6.1-7.8	0	0	0	0
	24-55	14-21	6.6-8.4	0	0	0	0
	55-80	12-18	6.6-8.4	0-5	0	0	0
GfB:							
Grandfield	0-8	9.0-14	6.1-7.8	0	0	0	0
	8-38	14-21	6.6-7.8	0	0	0	0
	38-60	14-21	6.6-8.4	0	0	0	0
	60-80	12-18	6.6-8.4	0-5	0	0	0
GfC:							
Grandfield	0-8	9.0-14	6.1-7.8	0	0	0	0
	8-39	14-21	6.1-7.8	0	0	0	0
	39-62	14-21	6.6-8.4	0	0	0	0
	62-80	12-18	6.6-8.4	0-5	0	0	0
HaC:							
Hardeman	0-12	5.0-10	7.4-8.4	0	0	0.0-2.0	0
	12-33	5.0-10	7.4-8.4	0	0	0.0-2.0	0
	33-80	5.0-10	7.4-8.4	0	0	0.0-2.0	0
JaC:							
Jaywi	0-5	15-25	7.9-8.4	10-20	0	0.0-2.0	0
	5-21	15-25	7.9-8.4	5-20	0-5	0.0-2.0	0-1
	21-80	15-25	7.9-8.4	2-10	1-5	2.0-4.0	0-2
JeE:							
Jester	0-11	2.0-10	7.4-8.4	0-10	0	0.0-2.0	0
	11-80	2.0-10	7.9-8.4	0-10	0	0.0-2.0	0
KgA:							
Kingco	0-12	15-30	7.4-8.4	0-2	0	0.0-1.0	0-1
	12-51	25-40	7.4-8.4	2-10	0-5	1.0-6.0	0-3
	51-82	20-35	7.9-8.4	2-10	2-10	3.0-8.0	1-10
KVD:							
Knoco	0-7	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	7-16	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	16-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8

Table 26.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 gg	pH	Pct	Pct	mmhos/cm	
Vernon	0-4	15-25	7.9-8.4	1-5	0	0.0-2.0	0-2
	4-10	20-35	7.9-8.4	1-5	0	0.0-2.0	0-2
	10-23	20-35	7.9-8.4	3-15	0	0.0-2.0	0-2
	23-29	20-35	7.9-8.4	3-15	0-2	2.0-8.0	5-15
	29-80	15-25	7.9-8.4	1-5	0-2	2.0-8.0	10-25
LaA:							
Lazare	0-12	35-50	6.6-8.4	0-2	0	0.0-2.0	0
	12-69	35-50	7.4-8.4	0-5	0	0.0-2.0	0
	69-90	35-50	7.4-8.4	0-5	0	0.0-2.0	0
LnA:							
Lincoln	0-6	4.0-10	7.4-8.4	0-5	0	0	0
	6-80	4.0-10	7.9-8.4	0-5	0	0	0
M-W:							
Water, miscellaneous	---	---	---	---	---	---	---
MfA:							
Miles	0-14	5.0-15	6.1-7.8	0-3	0	0	0
	14-19	10-20	6.6-8.4	0-3	0	0	0
	19-49	10-20	6.6-8.4	0-10	0	0	0
	49-80	5.0-15	7.4-8.4	0-20	0	0	0
NoC:							
Nobscot	0-29	2.0-5.0	6.1-7.3	0	0	0	0
	29-43	5.0-9.0	6.1-7.3	0	0	0	0
	43-90	2.0-6.0	6.1-7.3	0	0	0	0
NpB:							
Nipsum	0-29	15-30	7.4-8.4	0-3	0	0.0-2.0	0
	29-80	15-30	7.9-8.4	3-12	1-10	0.0-2.0	0
ObC:							
Obaro	0-7	10-15	7.9-8.4	0-15	0	0.0-2.0	0
	7-23	13-21	7.9-8.4	1-20	0	0.0-2.0	0
	23-38	13-21	7.9-8.4	3-25	0	0.0-2.0	0
	38-43	---	7.9-8.4	0	0	0	0
PdB:							
Paducah	0-8	5.0-15	6.6-7.8	0	0	0.0-2.0	0
	8-13	5.0-15	7.4-7.8	0	0	0.0-2.0	0
	13-39	10-20	7.4-8.4	2-5	0	0.0-2.0	0
	39-62	5.0-15	7.9-8.4	5-15	0	0.0-2.0	0
	62-80	5.0-15	7.9-8.4	0-3	0	0.0-2.0	0
QnB:							
Quanah	0-18	15-25	7.9-8.4	1-5	0	0.0-2.0	0
	18-34	15-25	7.9-8.4	1-5	0	0.0-2.0	0
	34-50	15-25	7.9-8.4	2-10	0	0.0-2.0	0
	50-80	15-25	7.9-8.4	15-40	0	0.0-2.0	0
QTD:							
Quanah	0-10	15-25	7.9-8.4	1-5	0	0.0-2.0	0
	10-25	15-25	7.9-8.4	2-10	0	0.0-2.0	0
	25-80	15-25	7.9-8.4	15-40	0	0.0-2.0	0
Talpa	0-8	5.0-20	7.9-8.4	10-40	0	0	0
	8-20	---	---	---	---	---	---
	20-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8

Table 26.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
QUG:							
Quinlan	0-4	10-17	7.4-8.4	0-10	0-3	0	0
	4-11	7.0-18	7.4-8.4	0-15	0-15	0	0
	11-16	7.0-18	7.4-8.4	0-15	0-15	0	0
	16-35	---	---	---	0-15	---	---
Rock outcrop	0-40	---	---	---	---	---	---
RCG:							
Rock outcrop	0-80	---	---	---	---	---	---
Cottonwood	0-9	10-15	7.9-8.4	5-30	5-40	0	0
	9-20	---	---	---	---	---	---
ShB:							
Shrewder	0-14	6.0-11	6.1-7.8	0	0	0	0
	14-55	6.0-11	6.6-8.4	0-5	0	0	0
	55-65	6.0-11	7.4-8.4	1-10	0	0	0
	65-80	---	---	0-5	---	---	---
ShC:							
Shrewder	0-16	6.0-11	6.1-7.8	0	0	0	0
	16-51	6.0-11	6.6-8.4	0-5	0	0	0
	51-60	6.0-11	7.4-8.4	1-10	0	0	0
	60-80	---	---	0-3	---	---	---
SpA:							
St. Paul	0-18	9.0-16	6.6-7.8	0	0	0	0
	18-24	11-21	6.6-7.8	0	0	0	0
	24-32	16-21	7.4-8.4	0-5	0	0	0
	32-46	16-24	7.4-8.4	0-5	0	0	0
	46-63	12-24	7.4-8.4	1-10	0	0	0
	63-80	9.0-21	7.9-8.4	1-10	0	0	0
TaC:							
Talpa	0-9	5.0-20	7.9-8.4	10-40	0	0	0
	9-53	---	---	---	---	---	---
	53-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
TKG:							
Talpa	0-9	5.0-20	7.9-8.4	10-40	0	0.0-2.0	0
	9-16	---	---	---	---	---	---
	16-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
Knoco	0-5	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	5-14	12-24	7.4-8.4	1-8	0-15	1.0-8.0	0-8
	14-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
Rock outcrop	0-80	---	---	---	---	---	---
TQB:							
Talpa	0-14	5.0-20	7.9-8.4	10-40	0	0	0
	14-20	---	---	---	---	---	---
	20-80	14-42	7.4-8.4	1-8	0-15	1.0-8.0	0-8
Quanah	0-10	15-25	7.9-8.4	1-5	0	0.0-2.0	0
	10-15	15-25	7.9-8.4	1-5	0	0.0-2.0	0
	15-55	15-25	7.9-8.4	2-10	0	0.0-2.0	0
	55-80	15-25	7.9-8.4	15-40	0	0.0-2.0	0

Table 26.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
TvB:							
Tilvern--------------	0-5	17-30	7.4-8.4	0-5	0	0.0-2.0	0-2
	5-12	15-30	7.9-8.4	2-10	0	0.0-2.0	0-4
	12-46	15-30	7.9-8.4	2-10	0-5	0.0-8.0	1-15
	46-53	15-30	7.9-8.4	2-10	0-5	0.0-8.0	1-15
	53-80	15-25	7.9-8.4	4-20	1-5	2.0-8.0	6-20
W:							
Water----------------	---	---	---	---	---	---	---
WcA:							
Westill--------------	0-10	10-20	6.6-8.4	0	0	0.0-2.0	0-1
	10-15	15-30	7.4-8.4	2-5	0-2	0.0-2.0	0-1
	15-22	15-30	7.4-8.4	2-5	0-2	0.0-2.0	0-1
	22-58	15-30	7.9-8.4	5-20	0-2	0.0-8.0	0-1
	58-80	15-30	7.9-8.4	2-15	0-2	0.0-8.0	0-1
WeA:							
Westola--------------	0-5	7.0-11	7.4-8.4	1-5	0	0	0
	5-41	4.0-11	7.9-8.4	1-10	0	0	0
	41-80	4.0-11	7.9-8.4	1-10	0	0	0
WfA:							
Westola--------------	0-4	7.0-11	7.4-8.4	1-5	0	0	0
	4-14	4.0-11	7.9-8.4	1-10	0	0	0
	14-80	4.0-11	7.9-8.4	1-10	0	0	0
WhA:							
Wheatwood------------	0-4	10-20	7.9-8.4	1-5	0	0	0
	4-44	10-20	7.9-8.4	2-5	0	0	0
	44-80	10-20	7.9-8.4	5-10	0-2	0	0-4
WoC:							
Woodward-------------	0-8	7.0-11	7.4-8.4	0-10	0	0	0
	8-38	7.0-11	7.4-8.4	2-15	0	0	0
	38-72	---	---	---	---	---	---
WoD:							
Woodward-------------	0-12	7.0-11	7.4-8.4	0-10	0	0	0
	12-34	7.0-11	7.4-8.4	2-15	0	0	0
	34-80	---	---	---	---	---	---
WQF:							
Woodward-------------	0-7	7.0-11	7.4-8.4	0-10	0	0	0
	7-28	7.0-11	7.4-8.4	2-15	0	0	0
	28-80	---	---	---	---	---	---
Quinlan--------------	0-5	10-17	7.4-8.4	0-10	0-1	0	0
	5-11	10-17	7.4-8.4	0-10	0-1	0	0
	11-16	7.0-18	7.4-8.4	0-15	0-2	0	0
	16-80	---	---	---	---	---	---
WQG:							
Woodward-------------	0-9	7.0-11	7.4-8.4	0-10	0	0	0
	9-29	7.0-11	7.4-8.4	2-15	0	0	0
	29-80	---	---	---	---	---	---
Quinlan--------------	0-4	10-17	7.4-8.4	0-10	0-1	0	0
	4-14	7.0-18	7.4-8.4	0-15	0-2	0	0
	14-80	---	---	---	---	---	---
Rough broken land----	0-40	10-15	7.4-8.4	0-5	0-2	0.0-2.0	0

Table 26.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	pH	Pct	Pct	mmhos/cm	
YmA:							
Yomont---------------	0-8	5.0-10	7.9-8.4	2-10	0	0.0-2.0	0
	8-80	5.0-10	7.9-8.4	2-10	0	0.0-2.0	0
YtA:							
Yomont---------------	0-10	5.0-10	7.9-8.4	2-10	0	0.0-2.0	0
	10-80	5.0-10	7.9-8.4	2-10	0	0.0-2.0	0

Table 27.--Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
AcA:										
Acme-----------------------	C	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
AsC:										
Aspermont------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
BKF:										
Badland--------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
Knoco	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
BmA:										
Beckman	D	High								
			April	---	---	---	---	None	Very brief	Frequent
			May	---	---	---	---	None	Very brief	Frequent
			June	---	---	---	---	None	Very brief	Frequent
			July	---	---	---	---	None	Very brief	Frequent
			August	---	---	---	---	None	Very brief	Frequent
			September	---	---	---	---	None	Very brief	Frequent
			October	---	---	---	---	None	Very brief	Frequent
CaA:										
Carey	B	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
CKF:										
Cottonwood	C	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Knoco----------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
DeC: Delwin--------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
DvD: Devol---------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
EnB:										
Enterprise-----------------	B	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
EnC:										
Enterprise-----------------	B	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
FoA:										
Foursixes------------------	C	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
FrB:										
Frankirk-------------------	C	Medium								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
GdB:										
Grandfield-----------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
GdC2:										
Grandfield, moderately eroded--------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
GfB:										
Grandfield	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
GfC:										
Grandfield	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
HaC:										
Hardeman	B	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
JaC:										
Jaywi	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
JeE:										
Jester	A	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
KgA:										
Kingco	D	Medium								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
KVD:										
Knoco	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Vernon	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
LaA:										
Lazare	D	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			May	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			June	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			July	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			August	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			September	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			October	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			November	0.0	1.0-3.0	0.0-3.0	Brief	Occasional	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
LnA:										
Lincoln-------------------	A	Negligible								
			January	5.0-6.7	>6.0	---	---	None	---	---
			February	5.0-6.7	>6.0	---	---	None	---	---
			March	5.0-6.7	>6.0	---	---	None	---	---
			April	5.0-6.7	>6.0	---	---	None	Brief	Frequent
			May	5.0-6.7	>6.0	---	---	None	Brief	Frequent
			June	---	---	---	---	None	Brief	Frequent
			July	---	---	---	---	None	Brief	Frequent
			August	---	---	---	---	None	Brief	Frequent
			September	---	---	---	---	None	Brief	Frequent
			October	---	---	---	---	None	Brief	Frequent
			November	5.0-6.7	>6.0	---	---	None	---	---
			December	5.0-6.7	>6.0	---	---	None	---	---
M-W:										
Water, miscellaneous------	---	---	Jan-Dec	---	---	---	---	None	---	---
MfA:										
Miles---------------------	B	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
NoC:										
Nobscot-------------------	A	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
NpB:										
Nipsum----------------------	C	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
ObC:										
Obaro-----------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
PdB:										
Paducah---------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
QnB:										
Quanah	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
QTD:										
Quanah	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Talpa	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro- logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
QUG:										
Quinlan-------------------	C	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Rock outcrop--------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
RCG:										
Rock outcrop--------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
Cottonwood-----------------	C	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
ShB:										
Shrewder------------------	B	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
ShC:										
Shrewder------------------	B	Very low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

				Water table		Ponding			Flooding	
Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
SpA:										
St. Paul-------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
TaC:										
Talpa----------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
TKG:										
Talpa----------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
Knoco----------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Rock outcrop--------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
TQB:										
Talpa----------------------	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

				Water table		Ponding			Flooding	
Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
Quanah	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
TvB:										
Tilvern	D	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
W:										
Water	---	---								
			Jan-Dec	---	---	---	---	None	---	---
WcA:										
Westill	D	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
WeA:										
Westola--------------------	B	Negligible								
			April	---	---	---	---	None	Very brief	Occasional
			May	---	---	---	---	None	Very brief	Occasional
			June	---	---	---	---	None	Very brief	Occasional
			July	---	---	---	---	None	Very brief	Occasional
			August	---	---	---	---	None	Very brief	Occasional
			September	---	---	---	---	None	Very brief	Occasional
			October	---	---	---	---	None	Very brief	Occasional
WfA:										
Westola--------------------	B	Negligible								
			April	---	---	---	---	None	Very brief	Frequent
			May	---	---	---	---	None	Very brief	Frequent
			June	---	---	---	---	None	Very brief	Frequent
			July	---	---	---	---	None	Very brief	Frequent
			August	---	---	---	---	None	Very brief	Frequent
			September	---	---	---	---	None	Very brief	Frequent
			October	---	---	---	---	None	Very brief	Frequent
WhA:										
Wheatwood------------------	B	Negligible								
			April	---	---	---	---	None	Very brief	Frequent
			May	---	---	---	---	None	Very brief	Frequent
			June	---	---	---	---	None	Very brief	Frequent
			July	---	---	---	---	None	Very brief	Frequent
			August	---	---	---	---	None	Very brief	Frequent
			September	---	---	---	---	None	Very brief	Frequent
			October	---	---	---	---	None	Very brief	Frequent
			November	---	---	---	---	None	Very brief	Frequent
WoC:										
Woodward-------------------	B	Low								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro- logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
WoD:										
Woodward-------------------	B	Medium								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
WQF:										
Woodward-------------------	B	Medium								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Quinlan--------------------	C	Medium								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
WQG:										
Woodward------------------	B	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Quinlan-------------------	C	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
Rough broken land---------	C	Very high								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	---	---	None	---	None
			June	---	---	---	---	None	---	None
			July	---	---	---	---	None	---	None
			August	---	---	---	---	None	---	None
			September	---	---	---	---	None	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 27.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	Ft	Ft				
YmA:										
Yomont	B	Negligible								
			April	---	---	---	---	None	Very brief	Occasional
			May	---	---	---	---	None	Very brief	Occasional
			June	---	---	---	---	None	Very brief	Occasional
			July	---	---	---	---	None	Very brief	Occasional
			August	---	---	---	---	None	Very brief	Occasional
			September	---	---	---	---	None	Very brief	Occasional
			October	---	---	---	---	None	Very brief	Occasional
			November	---	---	---	---	None	Very brief	Occasional
YtA:										
Yomont	B	Negligible								
			April	---	---	---	---	None	Very brief	Frequent
			May	---	---	---	---	None	Very brief	Frequent
			June	---	---	---	---	None	Very brief	Frequent
			July	---	---	---	---	None	Very brief	Frequent
			August	---	---	---	---	None	Very brief	Frequent
			September	---	---	---	---	None	Very brief	Frequent
			October	---	---	---	---	None	Very brief	Frequent
			November	---	---	---	---	None	Very brief	Frequent

Table 28.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
		In	In			
AcA:						
Acme	---	---	---	---	High	High
AsC:						
Aspermont	Bedrock (densic)	40-60	---	Noncemented	Moderate	Low
BKF:						
Badland	Bedrock (densic)	0-3	---	Noncemented	High	Low
Knoco	Bedrock (densic)	3-20	---	Noncemented	High	Low
BmA:						
Beckman	---	---	---	---	High	Moderate
CaA:						
Carey	Bedrock (densic)	60-80	---	Noncemented	Moderate	Low
CKF:						
Cottonwood	Bedrock (paralithic)	3-14	---	Moderately cemented	High	High
Knoco	Bedrock (densic)	3-20	---	Noncemented	High	Low
DeC:						
Delwin	---	---	---	---	Moderate	Low
DvD:						
Devol	---	---	---	---	Low	Low
EnB:						
Enterprise	---	---	---	---	Low	Low
EnC:						
Enterprise	---	---	---	---	Low	Low
FoA:						
Foursixes	Bedrock (lithic)	20-40	---	Indurated	High	Low
	Bedrock (densic)	40-60	---	Noncemented		
FrB:						
Frankirk	---	---	---	---	High	Low
GdB:						
Grandfield	---	---	---	---	Low	Low

Table 28.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
		In	In			
GdC2:						
Grandfield, moderately eroded	---	---	---	---	Low	Low
GfB:						
Grandfield	---	---	---	---	Low	Low
GfC:						
Grandfield	---	---	---	---	Low	Low
HaC:						
Hardeman	---	---	---	---	Low	Low
JaC:						
Jaywi	---	---	---	---	Moderate	Low
JeE:						
Jester	---	---	---	---	Low	Low
KgA:						
Kingco	---	---	---	---	High	Low
KVD:						
Knoco	Bedrock (densic)	3-20	---	Noncemented	High	Low
Vernon	Bedrock (densic)	20-40	---	Noncemented	High	Low
LaA:						
Lazare	---	---	---	---	High	Low
LnA:						
Lincoln	---	---	---	---	Low	Low
M-W:						
Water, miscellaneous	---	---	---	---	---	---
MfA:						
Miles	---	---	---	---	Moderate	Low
NoC:						
Nobscot	---	---	---	---	Low	Moderate
NpB:						
Nipsum	---	---	---	---	High	Low
ObC:						
Obaro	Bedrock (densic)	20-40	---	Noncemented	Low	Low

Table 28.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
		In	In			
PdB:						
Paducah	Bedrock (densic)	60-80	---	Noncemented	Moderate	Low
QnB:						
Quanah	---	---	---	---	Moderate	Low
QTD:						
Quanah	---	---	---	---	Moderate	Low
Talpa	Bedrock (lithic)	5-20	---	Indurated	High	Low
QUG:						
Quinlan	Bedrock (densic)	10-20	---	Noncemented	Moderate	Low
Rock outcrop	Bedrock (lithic)	0-2	---	Indurated	High	Low
RCG:						
Rock outcrop	Bedrock (lithic)	0-2	---	Indurated	High	Low
Cottonwood	Bedrock (lithic)	3-14	---	Moderately cemented	High	High
ShB:						
Shrewder	Bedrock (densic)	60-80	---	Noncemented	Low	Low
ShC:						
Shrewder	Bedrock (densic)	58-80	---	Noncemented	Low	Low
SpA:						
St. Paul	---	---	---	---	Moderate	Low
TaC:						
Talpa	Bedrock (lithic)	5-20	---	Indurated	High	Low
TKG:						
Talpa	Bedrock (lithic)	5-20	---	Indurated	High	Low
Knoco	Bedrock (densic)	3-20	---	Noncemented	High	Low
Rock outcrop	Bedrock (lithic)	0-2	---	Indurated	High	Low
TQB:						
Talpa	Bedrock (lithic)	5-20	---	Indurated	High	Low
Quanah	---	---	---	---	Moderate	Low

Table 28.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Uncoated steel	Concrete
		In	In			
TvB:						
Tilvern	Bedrock (densic)	40-60	---	Noncemented	High	Low
W:						
Water	---	---	---	---	---	---
WcA:						
Westill	Bedrock (densic)	40-60	---	Noncemented	High	Low
WeA:						
Westola	---	---	---	---	Low	Low
WfA:						
Westola	---	---	---	---	Low	Low
WhA:						
Wheatwood	---	---	---	---	Moderate	Low
WoC:						
Woodward	Bedrock (densic)	20-40	---	Noncemented	Low	Low
WoD:						
Woodward	Bedrock (densic)	20-40	---	Noncemented	Low	Low
WQF:						
Woodward	Bedrock (densic)	20-40	---	Noncemented	Low	Low
Quinlan	Bedrock (densic)	10-20	---	Noncemented	Moderate	Low
WQG:						
Woodward	Bedrock (densic)	20-40	---	Noncemented	Low	Low
Quinlan	Bedrock (densic)	10-20	---	Noncemented	Moderate	Low
Rough broken land	Bedrock (paralithic)	0-3	---	Moderately cemented	Moderate	Low
YmA:						
Yomont	---	---	---	---	Low	Low
YtA:						
Yomont	---	---	---	---	Low	Low

Table 29.--Physical Analysis of Selected Soils

(The abbreviation “COLE” means coefficient of linear extensibility. Analyses by the Soil Survey Laboratory, Lincoln, Nebraska. Dashes indicate that data were not available.)

			Particle-size distribution								Water content	Bulk density	
			Sand										
Soil name and sample number	Depth	Horizon	Very coarse (2.0-1.0 mm)	Coarse (1.0-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	1/3 bar	1/3 bar	COLE
	In		---------------------------- Pct ----------------------------								Pct	g/cc	Cm/Cm
Tilvern(1)	0-4	A	TR	0.1	0.3	0.9	6.1	7.4	55.2	37.4	24.9	1.33	0.046
S98TX269001	4-10	Bw	0.2	0.1	0.4	0.9	4.9	6.5	39.2	54.3	29.3	1.34	0.099
	10-19	Bk	0.4	0.3	0.5	1.0	5.0	7.2	41.0	51.8	25.5	1.46	0.077
	19-30	Bssk1	1.0	0.6	0.6	1.2	4.7	8.1	41.1	50.8	24.2	1.52	0.079
	30-41	Bssk2	0.4	0.6	0.6	0.9	4.3	6.8	40.7	52.5	25.4	1.50	0.084
	41-57	Bky	0.1	0.3	0.3	0.7	3.6	5.0	41.7	53.3	25.2	1.53	0.067
	57-66	Cd1	0.1	0.5	0.4	0.4	2.5	3.9	43.1	53.0	25.8	1.53	0.053
	66-69	Cd2	0.1	0.2	0.1	0.5	1.4	2.3	46.4	51.3	-	-	-

(1) Location of the pedon sampled: From the courthouse in Guthrie; 11.7 miles south on U.S. Highway 83; 3,100 feet east on Croton Creek Ranch entrance road; and 440 feet south in rangeland. This pedon is similar to the pedon sampled as typical for the series.

Table 30.--Chemical Analysis of Selected Soils

(Analyses by the Soil Survey Laboratory, Lincoln, Nebraska. Dashes indicate that analyses were not made.)

Soil name and sample number	Depth	Horizon	Extractable bases				Base saturation	pH 1:1 (soil: water)	Electric Conductivity	Sodium adsorption ratio (SAR)	Exchange-able sodium (ESP)	Calcium carbonate equivalent
			Ca	Mg	K	Na						
	In		------Meq/100g-------				Pct	pH	(mmhos/cm)		Pct	Pct
Tilvern (1)	0-4	A	15.5	4.9	1.9	0.1	96.0	7.3	-	-	TR	
S98TX269001	4-10	Bw	-	7.2	2.0	0.3	100.0	7.8	0.67	TR	1	1
	10-19	Bk	-	8.9	1.2	0.4	100.0	8.1	-	-	2	2
	19-30	Bssk1	-	11.2	0.7	1.3	100.0	8.2	0.81	2.0	4	4
	30-41	Bssk2	-	12.6	0.9	2.9	100.0	7.9	3.1	6.0	7	5
	41-57	Bky	-	3.8	0.5	4.3	100.0	7.7	7.1	6.0	10	4
	57-66	Cd1	-	9.4	0.6	3.8	100.0	7.5	6.61	6.0	8	4
	66-69	Cd2	-	8.9	0.6	3.5	100.0	7.5	6.73	6.0	9	17

(1) Location of the pedon sampled: From the courthouse in Guthrie; 11.7 miles south on U.S. Highway 83; 3,100 feet east on Croton Creek Ranch entrance road; and 440 feet south in rangeland. This pedon is similar to the pedon sampled as typical for the series.

Table 31.--Taxonomic Classification of the Soils

Soil name	Family or higher taxonomic class
Acme	Fine-silty, mixed, superactive, thermic Gypsic Calciustolls
Aspermont	Fine-silty, mixed, active, thermic Typic Calciustepts
Beckman	Fine, mixed, active, thermic Fluventic Haplustepts
Carey	Fine-silty, mixed, superactive, thermic Typic Argiustolls
Cottonwood	Loamy, mixed, superactive, calcareous, thermic Lithic Ustorthents
Delwin	Fine-loamy, mixed, active, thermic Typic Paleustalfs
Devol	Coarse-loamy, mixed, superactive, thermic Typic Haplustalfs
Enterprise	Coarse-silty, mixed, superactive, thermic Typic Haplustepts
Foursixes	Fine, mixed, superactive, thermic Typic Haplustalfs
Frankirk	Fine, mixed, superactive, thermic Typic Argiustolls
Grandfield	Fine-loamy, mixed, superactive, thermic Typic Haplustalfs
Hardeman	Coarse-loamy, mixed, superactive, thermic Typic Haplustepts
Jaywi	Fine-silty, mixed, active, thermic Typic Ustochrepts
Jester	Mixed, thermic Typic Ustipsamments
Kingco	Fine, mixed, active, thermic Typic Haplusterts
Knoco	Clayey, mixed, active, calcareous, thermic, shallow Aridic Ustorthents
Lazare	Fine, smectitic, thermic Udic Haplusterts
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Miles	Fine-loamy, mixed, superactive, thermic Typic Paleustalfs
Nipsum	Fine, mixed, superactive, thermic Cumulic Haplustolls
Nobscot	Loamy, mixed, superactive, thermic Arenic Paleustalfs
Obaro	Fine-silty, mixed, active, thermic Typic Haplustepts
Paducah	Fine-silty, mixed, superactive, thermic Typic Haplustalfs
Quanah	Fine-silty, mixed, superactive, thermic Typic Calciustolls
Quinlan	Loamy, mixed, superactive, thermic, shallow Typic Haplustepts
Shrewder	Coarse-loamy, mixed, superactive, thermic Typic Haplustepts
St. Paul	Fine-silty, mixed, superactive, thermic Pachic Argiustolls
Talpa	Loamy, mixed, superactive, thermic Lithic Calciustolls
Tilvern	Fine, mixed, active, thermic Vertic Haplustepts
Vernon	Fine, mixed, active, thermic Typic Haplustepts
Westill	Fine, mixed, superactive, thermic Vertic Argiustolls
Westola	Coarse-loamy, mixed, superactive, calcareous, thermic Typic Ustifluvents
Wheatwood	Fine-silty, mixed, active, thermic Fluventic Haplustepts
Woodward	Coarse-silty, mixed, superactive, thermic Typic Haplustepts
Yomont	Coarse-silty, mixed, superactive, calcareous, thermic Typic Ustifluvents

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