United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation
with Texas
Agricultural
Experiment
Station and
Texas Tech
University

Soil Survey of Deaf Smith 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.

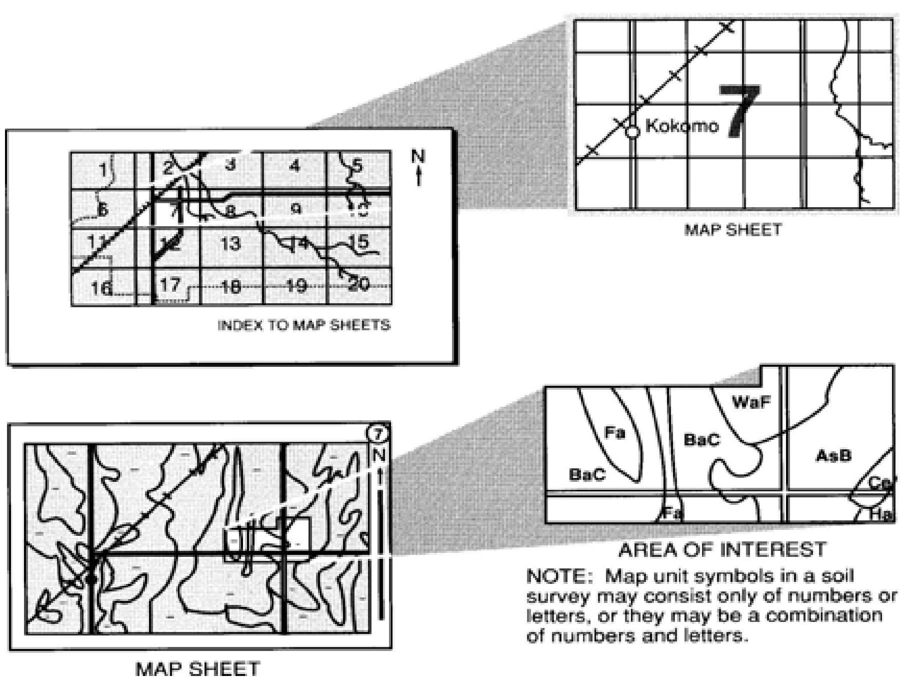
Detailed Soil Maps

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**.

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.



This soil survey special report 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 1999. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1999. This survey was made cooperatively by the Natural Resources Conservation Service, the Texas Agricultural Experiment Station, and Texas Tech University. The survey is part of the technical assistance furnished to the Tierra Blanca Soil and Water Conservation District.

Cover: Deaf Smith County is known as the “Beef Capital of the World” because of the large numbers of cattle that move through it’s feedlots every year.

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

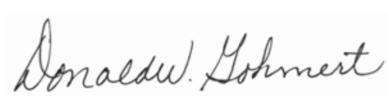
This soil survey contains information that affects land use planning in Deaf Smith County. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Planners can use the report 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 modify or improve the environment.

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 users identify and reduce the effects of soil limitations on various land uses. The 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 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 report. 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 report 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 Deaf Smith County, Texas

By Thomas C. Byrd, Natural Resources Conservation Service

Fieldwork by Fred B. Pringle, Dan A. Blackstock, Wilfred E. Crenwelge, Jim K. Attebury, Stanley R. Albee, and James A. Bauchert, Natural Resources Conservation Service; Dr. B.L. Allen, Texas Tech University

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
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Deaf Smith County (fig. 1) is on the western edge of the Texas Panhandle and is bounded on the west by Curry and Quay Counties, New Mexico; on the north by Oldham County; on the east by Randall County; and on the south by Parmer and Castro Counties.

It was named for Erastus "Deaf" Smith, a famous scout of the Texas Revolution. The county's center point is at 102°30' west longitude and 35°00' north latitude. Elevations range from 3,200 to 4,200 feet above sea level. Deaf Smith County makes up approximately 1,497 square miles, or 958,253 acres, of level prairies and rolling plains on the western edge of the Llano Estacado (Texas Online, DEAF SMITH COUNTY). The county is rectangular, about 50 miles from east to west and 30 miles from north to south. About 95 percent of the county is smooth tableland called the High Plains. The remainder, about 60,000 acres, is in the Canadian Breaks. The High Plains tableland is nearly level but tilted to the east at an average grade of 10 feet per mile. Slopes are linear, neither concave nor convex. Except for a few low rises and numerous playa depressions, the main surface is smooth (Texas Online, HEREFORD CENTER). The dish-shaped playas range in size from less than 1 acre to several hundred acres. They consist of a central basin in which runoff is held, a slightly higher nearly level bench, and an outer rim that slopes to the main surface. In the northwestern part of the county are the Canadian Breaks. Here, headwater erosion by the drainage system of the Canadian River has eroded sediments from the High Plains.

Most of Deaf Smith County is in the Southern High Plains, Major Land Resource Area (77). The High Plains part is almost treeless; although there are a few scattered mesquite and a few groves of cottonwood and hackberry along the creeks. The remainder of the county is in the Upper Pecos-Canadian Breaks and Plains, Major Land Resource Area (70) (USDA, 1981). In the Canadian Breaks, scattered juniper, cholla, yucca, and mesquite grow. The county has three moderate-sized stream channels that dissect the High Plains. Typically these streams are dry, but occasional flooding can briefly occur during heavy rainfall events. The largest stream is Tierra Blanca Creek. It heads in Curry County, New Mexico, runs eastward across the southern part of the county, and empties into the drainage system of the Red River. Palo Duro Creek and North Palo Duro Creek head in the western part of the county and, likewise, drain eastward into the Red River System.

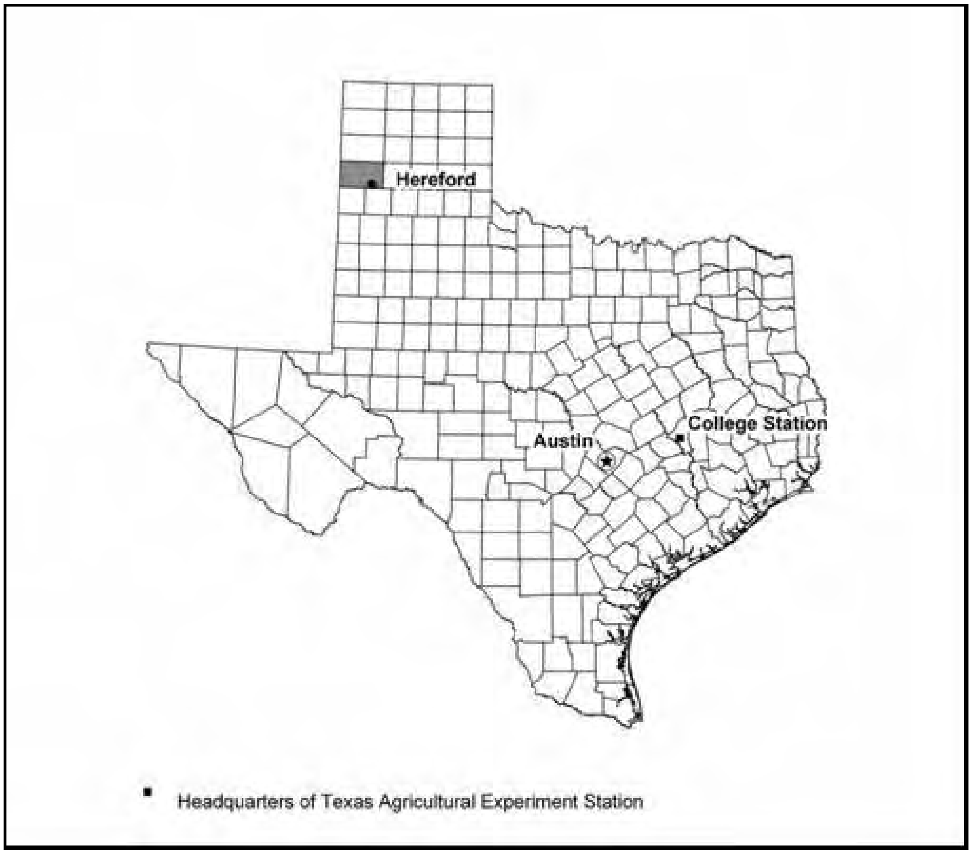

Figure 1.—Location of Deaf Smith County, Texas.

Hereford is the county seat and only urban center. In 2000, the town had six public elementary schools, a junior high and high school, county library, and the Deaf Smith County Historical Museum. Other communities in Deaf Smith County include Bootleg, Dawn, Ford, Glenrio, Simms, Walcott, and Westway. In 2000, the total resident population for the county was 18,561 (Census, 2000).

The major land uses in Deaf Smith County are farming and cattle ranching. Approximately 637,348 acres in the county is used as cropland, 311,825 acres as rangeland, 2,373 acres as pasture and hayland, and 6,707 acres as urban or built-up land (USDA, 2002).

This soil survey updates the survey of Deaf Smith County, Texas published in 1968 (USDA, 1968). It provides additional soils information and detail on soil properties and interpretations and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

This section gives general information about the county. It describes history, economic enterprises, natural resources, transportation facilities, and climate.

History

The earliest prehistoric inhabitants of these prairies gave way to Plains Apaches, who in turn were forced out by the Comanches and Kiowas. In 1787, and again in 1788, José Mares followed Tierra Blanca Creek in his search for a route from Santa Fe to San

Antonio. The Indian wars of the 1870s, culminating in the Red River War of 1874-75, led to the removal of the native American population to Indian Territory. Shortly thereafter, ranchers began to appear in the area, and in 1876, the Texas legislature formed Deaf Smith County from the Bexar District. The census counted thirty-eight people in the county in 1880.

By the early 1880s, the T Anchor Ranch, headquartered near the site of present-day Canyon, had spilled over into the eastern part of the county, and the LS Ranch extended over into its northeastern portion. Beginning in 1882, the western half of the county lay within the XIT Ranch, a real estate-cattle project of the Capitol Syndicate. One of the eight XIT division headquarters was established at Las Escarbadas, on Tierra Blanca Creek, in the southwestern corner of Deaf Smith County. The large ranches dominated the county; only a few small stock farms existed among them. By 1890 the county's population had increased to 179, and the census found seventeen farms or ranches in the area, seven of which were smaller than 500 acres. More than 28,600 cattle were counted in the county, while crop production occupied only a few acres: 78 acres were planted in corn and 80 acres in cotton.

As the cattle industry in the county developed, the rising population created a need for local government. Accordingly, after an election on December 1, 1890, the county was organized with the new town of La Plata as county seat. Jerry R. Dean was elected the first county judge, and the colorful Jim Cook became the first county sheriff. In 1898 the Pecos and Northern Texas Railway, a subsidiary of the Santa Fe line, built tracks from Amarillo to the Texas-New Mexico border at Farwell. This railroad crossed the southeastern corner of Deaf Smith County and brought easy and economical transportation to the local ranchers. The coming of the railroad also brought forth the new town of Hereford, which quickly outstripped the other local hamlets. Consequently Hereford became the county seat after an election on November 8, 1898 (Texas Online, DEAF SMITH COUNTY).

Glenrio a border town which straddles the Texas and New Mexico line in extreme northwestern Deaf Smith County was opened in 1905 to small farmers, who settled on choice 150-acre plots. In 1906 the Chicago, Rock Island and Gulf Railway established a station at Glenrio, and the community bustled with cattle and freight shipments. Although a post office was established on the New Mexico side of the community, the depot where the mail arrived was on the Texas side. By 1920, Glenrio had a hotel, a hardware store, and a land office, as well as several grocery stores, service stations, and cafes. A newspaper, the Glenrio Tribune, was published from 1910 to 1934. After U.S. Highway 66 was routed through the town, a "welcome station" was built near the state line. Some scenes in the 1940 movie Grapes of Wrath were filmed at the community. By 1945, Glenrio had a population of thirty. The moving of Route 66 when it became Interstate Highway 40 resulted in the town's decline. The Rock Island depot was closed in 1955. In the 1980s, the post office and two residences remained at Glenrio (Texas Online, GLENRIO).

Deaf Smith County had ninety-seven ranches and farms and a population of 843 citizens by 1900. Between 1900 and 1910 the large ranchers began to sell their lands, and land-company promotions brought a rush of settlers to the area. With them came significant changes in the local agricultural economy during the first half of the twentieth century. The number of farms and ranches in the county increased steadily during most of this period, rising to 361 in 1910, 382 in 1920, 605 in 1930, and 854 in 1940. The expansion of farming was responsible for most of this growth (Texas Online, DEAF SMITH COUNTY).

By 1900, Hereford was a thriving railroad town with a population of 532. The first public school opened in 1900. From the town's beginning, Hereford's residents depended upon wells for their water. The plentiful groundwater supply was a major attraction to newcomers to the area. As early as 1904, Hereford was called the Windmill City because of the 400 windmills that dotted the landscape. Most of the early agriculture in the area was single-crop dryland farming of wheat or sugar beets. In 1910, however, D. L. McDonald sank the first successful irrigation well in the Ogallala Aquifer north of town. Irrigated farming in the area became increasingly common in the 1930s and 1940s.

The city's reputation as the "town without a toothache" evidently began in 1948, when Dr. F. M. Butler attributed local dental health to natural fluoride in the water of the area. The Texas Department of Health later verified Butler's discoveries. Over the years, Hereford water came to be in worldwide demand, as did its grain products, which are widely sold in health-food stores. The citizens of Hereford endured the dust bowl years and eagerly supported the Civilian Conservation Corps, the Work Projects Administration, and other Federal relief programs. During World War II a prisoner of war camp, where mainly Italian prisoners were kept, was located south of Hereford. The Hereford Military Reservation and Reception Center occupied 800 acres of land in Castro and Deaf Smith Counties 3.5 miles southeast of Hereford. The second largest of the United States POW camps built during World War II, it housed approximately 5,000 Italian prisoners and about 750 United States military personnel. Although it was designated a temporary camp, the reservation was constructed as a maximum-security facility. The first internees arrived in April 1943. All were Italians, with the exception of one group of Germans who were routed to the camp by mistake and quickly transferred after a full-scale riot erupted between compounds. The maximum-security policy was soon replaced by a policy of maximum utilization, and enlisted men were hired out to work on local farms at a rate of ten cents an hour (Texas Online, HEREFORD CENTER).

Economic Enterprises

After World War II, businesses were started in Deaf Smith County to process and ship local products. Vegetable production was introduced on a large scale, and processing and packing plants for onions, potatoes, and other perishable vegetables were established. In 1964, the Holly Sugar Company opened its $20 million mill and refinery, having contracted with local farmers for the production of sugar beets.

Cattle feeding also began to flourish in the 1960s with the opening of several feedlots that used much locally grown grain. By the 1970s, these lots were bringing 80 percent of the county's $230 million annual average income. In the late 1980s, the county led the state in numbers of cattle fed; it often led the nation in this category. The establishment of feedlots brought commercial production of corn and the establishment of several meatpacking plants in the county. In 1982, Deaf Smith County produced more than 5.75 million bushels of sorghum, 4.75 million bushels of wheat, nearly 4 million bushels of corn, and 251,942 tons of sugar beets. Vegetable production occupied 2,153 acres, planted with carrots, onions, potatoes, and sweet corn.

The population grew steadily from World War II until the 1980s. The number of residents increased from 6,056 in 1940 to 9,111 in 1950, 13,187 in 1960, 18,999 in 1970, and 21,165 in 1980. Economic development brought other changes. The discovery and use of abundant underground water in the Ogallala Aquifer in the 1930s led to large-scale irrigation in the 1950s, which further encouraged the expansion of farming (Texas Online, DEAF SMITH COUNTY).

Agriculture and agribusiness are the principal industries in Deaf Smith County. Currently, wheat, cotton, grain sorghum, corn, and forage sorghum are the major crops raised in the county. In 2002, about 67 percent of the land in the county was irrigated or dryland crops (USDA, 2002).

The manufacturing and processing industries include a sugar refinery, a pet food manufacturer, a flourmill, food processing plants, agricultural chemical blending plants, beef processors, feed mills, grain elevators, and irrigation equipment manufacturing and maintenance plants.

The chief industry and largest source of agricultural revenue for Deaf Smith County is cattle feeding. The county is ranked number one in the world for beef production and is known as the "Beef Capital of the World." There are approximately 16 major feedlots operating in the county with capacities of 5,000 to 80,000 head of cattle. Smaller feedlots with less than 5,000 head are numerous and operate across the county. Feed corn, grain sorghum, forage sorghum, and silage, grown locally, are the main feeds. Approximately one million head of cattle are fed annually in the county. In addition to the feedlots, large cattle ranches in the western and southeastern part of the county manage cow-calf herds, and significant herds of stocker-feeder cattle are fattened on winter wheat pasture throughout the county. The dairy industry in Deaf Smith County is also on the rise. This is due primarily to ample feed production and a climate conducive to dairy production. The county currently has six milking dairies ranging in size from 2,500 head to 12,000 head.

Natural Resources

Soil is the most important natural resource in Deaf Smith County. The production of livestock, crops, and forages, which are sources of livelihood for many people in the county, all depend on soil.

Water is another important resource. The Ogallala underground aquifer provides water for municipal, industrial, and agricultural uses. Gravel, caliche, and sand deposits are utilized for the construction of roads and building sites.

Wildlife, especially waterfowl, are valuable resources in Deaf Smith County. Geese and ducks migrate by the thousands to the High Plains during the winter months. Hundreds of playa lakes provide food and nesting areas for several migratory waterfowl species. Deer are present in some parts of the county where adequate forage and cover is located. Also of importance are dove, pheasant, and quail.

Transportation Facilities

In the extreme northwest, Interstate Highway 40 passes through the border community of Glenrio from east to west. In the east, U.S. Highway 385 crosses Deaf Smith County from north to south through Hereford and Ford, and U.S. Highway 60 crosses southwest to northeast through Hereford and Dawn. In the west, State Highway 214 crosses north and south through the old communities of Bootleg, Walcott, and Simms. A full network of paved farm-to-market roads provide ready access to agricultural markets.

The Burlington Northern-Santa Fe Railroad crosses southwest to northeast following U.S. Highway 60 through Hereford and Dawn. In the northwest, the rail line follows Interstate Highway 40 from east to west through Glenrio.

Air service, which is limited to small aircraft, is located at the Hereford Municipal Airport.

Climate

Table 1 provides data on temperature and precipitation for the survey area as recorded at Hereford 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 length of the growing season.

In winter, the average temperature is 37.4 degrees F and the average daily minimum temperature is 23.1 degrees. The lowest temperature on record, which occurred at Hereford on February 1, 1951, was -17 degrees. In summer, the average temperature is 75.4 degrees and the average daily maximum temperature is 89.2 degrees. The highest recorded temperature, which occurred at Hereford on June 8, 1910, was 111 degrees.

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

The total annual precipitation is about 18.7 inches. Of this, 15.2 inches, or 81 percent, usually falls in April through October. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through October is less than 5.7 inches. The heaviest 1-day rainfall during the period of record was 5.3 inches on August 3, 1976. Thunderstorms occur on about 49 days each year, and most occur between May and August.

The average seasonal snowfall is about 13.9 inches. The greatest snow depth at any one time during the period of record was 18 inches recorded on February 5, 1964. The heaviest 1-day snowfall on record was 14.0 inches recorded on December 14, 1967. On the average, 11 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 40 percent. Humidity is higher at night, and the average at dawn is about 73 percent. The sun shines 78 percent of the time possible in summer and 69 percent in winter. The prevailing wind is from the south or southwest. Average wind speed is highest, between 15 and 16 miles per hour, in March and April (USDA, NWCC).

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 soil 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 delineation's 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.

Survey Procedures

Careful study of the original soil survey of Deaf Smith County was made, along with many field observations, before major fieldwork for this soil survey began. From these field observations soil scientists were able to determine where map units in the original survey would remain unchanged, which map units should be eliminated, and which new map units should be added to the update of the Deaf Smith County Soil Survey. Soil scientists studied U.S. Geological Survey topographic maps and aerial photographs, relating land and image features. Then the soil scientists made preliminary boundaries of slopes and landforms by stereoscopically plotting the boundaries on aerial photographs.

The soil scientists made traverses by truck on the existing network of roads and trails. Where there were no roads or trails, traverses were made on foot. Soil examinations along the traverses were made every 50 to 1,000 yards, depending on the landscape and soil pattern. The soil was examined with the aid of a hand auger, spade, or power probe to a depth of 5 to 7 feet. Many typical pedons were observed and studied in small pits that were dug by hand. Observations of landforms, surface geology, vegetation, road-cuts, excavations, and animal burrows were made continuously without regard to spacing. Soil boundaries were determined based on soil examinations and photo interpretation.

The soil scientists transected some of the map units to determine their composition and recorded the vegetation. They chose at least three delineations of each transected map unit to be representative of the unit. At least 10 observations 50 to 100 feet apart were made for most transects.

Samples for some of the engineering index test data (table 33) were taken from the sites of typical pedons of the major soils in the MLRA survey area. The National Soil Survey Laboratory, Lincoln, Nebraska, performed the analyses.

After completion of the field mapping, map unit delineations were transferred by hand to high-altitude aerial photographs at a scale of 1:24,000. Surface drainage and cultural features were transferred from 7½-minute U.S. Geological Survey topographic maps and were recorded from visual observations in the field..

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, 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. Pullman

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Geomorphic setting: This map unit is extensive and occurs throughout most of the county. The landscape consists of nearly level plains with numerous playa basins (fig. 2).

Map Unit Composition

Pullman and similar soils: 90 percent
Contrasting soils: 10 percent

These map units make up 498,296 acres, or about 52 percent of the county. They are about 90 percent Pullman soils, and 10 percent soils of minor extent. The minor soils in this map unit are Estacado, Lazbuddie, Lofton, McLean, Pep, Portales, and Randall soils. Estacado soils are on nearly level landscape positions similar to those of the Pullman soils. Lazbuddie soils are on nearly level playa steps in playa basins. Lofton soils are on nearly level playa steps or shallow drainageways. The McLean and Randall soils are on the nearly level floor of playa basins. Pep and Portales soils are on nearly level to gently sloping plains.

Soil Description

Pullman

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

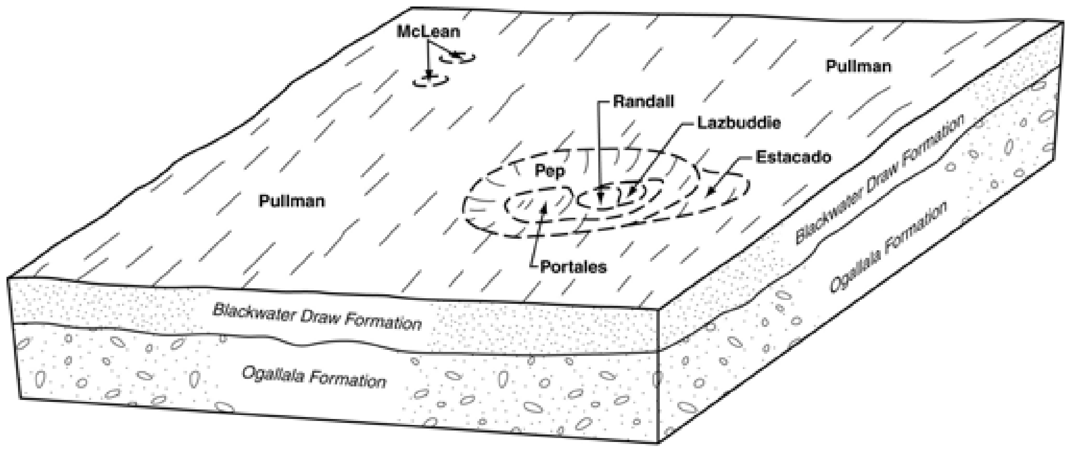

Figure 2.—Typical patterns of soils in the Pullman general soil map unit.

Typical Profile

Ap—0 to 5 inches; brown, neutral clay loam
Bt1—5 to 18 inches; brown, slightly alkaline clay
Bt2—18 to 33 inches; dark brown, slightly alkaline clay; slightly effervescent
Btk1—33 to 52 inches; brown, moderately alkaline clay; about 2 percent films, threads, concretions, and nodules of calcium carbonate; strongly effervescent
Btk2—52 to 66 inches; strong brown, moderately alkaline clay; about 25 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—66 to 80 inches; reddish yellow, moderately alkaline clay loam; about 40 percent masses, concretions, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.8 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36

Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Pullman soils are used extensively for cropland. A few small areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown on this soil are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. It is very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, septic tank absorption fields, trench sanitary landfills, and use as daily cover for landfills. The high shrink-swell potential, low soil strength, restricted permeability, and high clay content of the soil are major limitations. Shrinking and swelling can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to most recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

2. Pep-Estacado

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Geomorphic setting: This map unit occurs in the east-central part of the county between Palo Duro and Tierra Blanca Creeks. The landscape consists of nearly level and very gently sloping plains (fig. 3).

Map Unit Composition

Pep and similar soils: 42 percent
Estacado and similar soils: 31 percent
Contrasting soils: 27 percent

This map unit makes up 192,704 acres or about 20 percent of the county. It is about 58 percent Pep soils, 19 percent Estacado soils, and 23 percent soils of minor extent. The minor soils in this map unit are Drake, Kimberson, Lazbuddie, Lofton, McLean, Olton, Pantex, Portales, Pullman, and Randall. Drake soils are on dunes on the leeward edge of playas. Kimberson soils are on very gently sloping and slightly convex plains. Lazbuddie soils are on nearly level playa steps in playa basins. Lofton soils are on nearly level playa steps or shallow drainageways. The McLean and Randall soils are on the nearly level floor of playa basins. Olton, Pantex, and Pullman soils are on nearly level plains. Portales soils are on nearly level plains that are adjacent to playa basins.

Soil Description

Pep

Landscape: Plateausor tablelands
Landform: Plain; playa slope
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

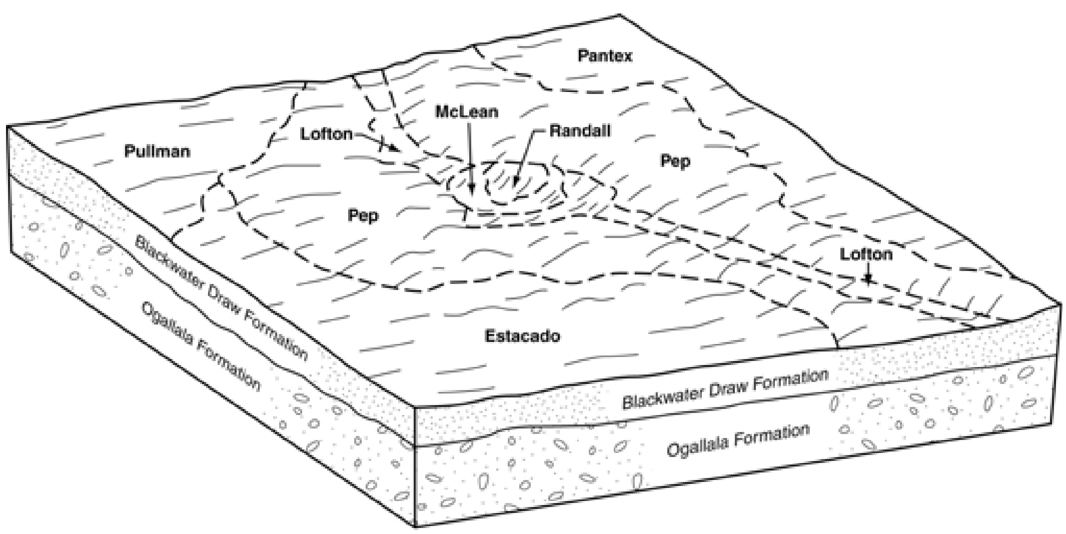

Figure 3.—Typical patterns of soils in the Pep-Estacado general soil map unit.

Typical Profile

Ap—0 to 9 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—9 to 15 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—15 to 31 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—31 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None

Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 3e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass and midgrass prairie.

Estacado

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 6 inches; dark grayish brown, moderately alkaline clay loam; strongly effervescent
Bt1—6 to 19 inches; brown, moderately alkaline clay loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bt2—19 to 38 inches; brown, moderately alkaline clay loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Btk1—38 to 50 inches; pink, moderately alkaline clay loam; about 40 percent films and masses of calcium carbonate; violently effervescent

Btk2—50 to 80 inches; pinkish white, moderately alkaline clay loam; about 35 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: Pep soils are moderately suited to cropland. The high carbonate content of the soil and moderate available water capacity are limitations. The most common crops grown are wheat, grain sorghum, cotton, and forage sorghum. Estacado soils are well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The hazard of wind erosion is severe for both soils. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: In the Pep soils native plants yield moderate amounts of forage. The high carbonate content of the soil and moderate available water capacity

are limitations. In the Estacado soils native plants are dominantly shortgrasses, which produce moderate amounts of forage. The hazard of wind erosion is severe for both soils. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Pep soils are moderately suited to most urban uses. They are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Estacado soils are well suited to most urban uses. They are very limited as a site for construction of roads and streets or use as roadfill material. The low soil strength is a major limitation. Stabilizing, strengthening, or replacing the base material can overcome these restrictions.

Recreational development: Pep soils are moderately suited to most recreational uses. They are very limited as a site for golf fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation. Estacado soils are well suited to recreational uses.

Wildlife habitat: For the Pep soils wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation for both soils.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

3. Olton

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico

Geomorphic setting: This map unit occurs in the southwestern part of the county. The landscape consists of broad nearly level plains (fig. 4).

Map Unit Composition

Olton and similar soils: 89 percent

Contrasting soils: 11 percent

This map unit makes up 71,825 acres or about 7 percent of the county. It is about 90 percent Olton soils, and 10 percent soils of minor extent. The minor soils in this map unit are the Estacado, Lofton, McLean, Pep, Portales, and Randall soils. Estacado soils are on nearly level plains in positions similar to those of the Olton soils. Lofton soils are on nearly level playa steps or shallow drainageways. The McLean and Randall soils are on the nearly level floor of playa basins. Pep soils are on nearly level or very gently sloping plains and playa slopes. Portales soils are on nearly level plains adjacent to playa basins.

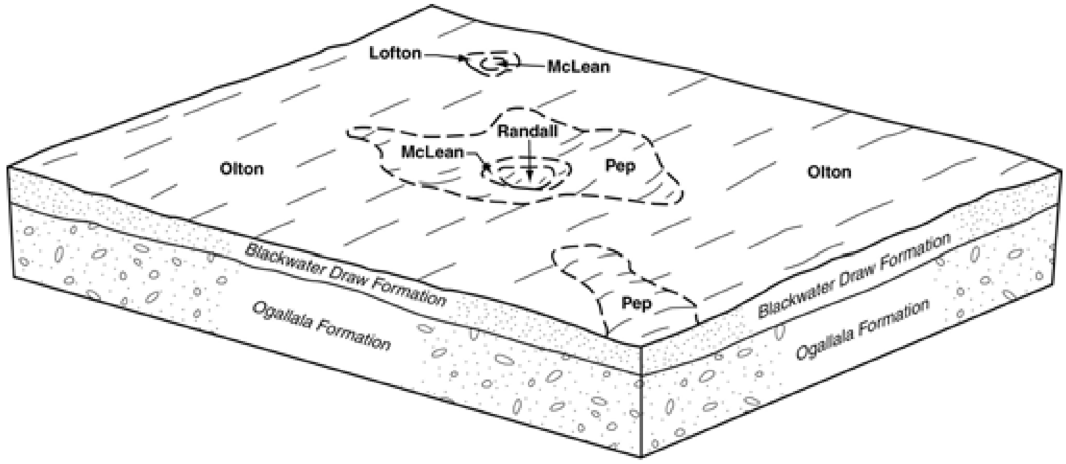

Figure 4.—Typical patterns of soils in the Olton general soil map unit.

Soil Description

Olton

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 8 inches; brown, neutral clay loam
Bt1—8 to 15 inches; brown, slightly alkaline clay loam
Bt2—15 to 31 inches; reddish brown, moderately alkaline clay loam; slightly effervescent
Btk1—31 to 48 inches; reddish brown, moderately alkaline clay loam; about 5 percent films and threads of calcium carbonate; violently effervescent
Btk2—48 to 75 inches; pink, moderately alkaline clay loam; about 35 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—75 to 80 inches; red, moderately alkaline clay loam; about 5 percent films of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Well drained

Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: This soil is used extensively for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include alfalfa, forage sorghum, and soybeans. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for septic tank absorption fields and for local roads and streets. The low soil strength and restricted permeability are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. The moderately slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. The shrink-swell potential is somewhat limiting for dwellings or small commercial buildings. Shrinking and swelling can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils.
Recreational development: This soil is well suited to recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

4. Pep-Plemons

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Geomorphic setting: This map unit occurs along the slopes of Tierra Blanca and Palo Duro Creeks. The landscape consists of ancient, meandering stream channels that have incised into the surrounding plains. Pep soils occur on nearly level or very gently sloping plains adjacent to the draw. Plemons soils are on gently sloping upper backslopes and similar hillslope positions of the draw (fig. 5).

Map Unit Composition

Pep and similar soils: 56 percent
Plemons and similar soils: 12 percent
Contrasting soils: 32 percent

This map unit makes up 43,903 acres or about 5 percent of the county. It is about 56 percent Pep, 12 percent Plemons, and 32 percent soils of minor extent. The minor soils in this map unit are Berda, Bippus, Estacado, Lofton, Potter, and Pullman soils. Berda soils are on very gently sloping to strongly sloping backslopes and footslope positions of the draw. Bippus soils are on nearly level flood plains. Estacado and Pullman soils are on nearly level or very gently sloping plains. Lofton soils are on nearly level playa steps or shallow drainageways. Potter soils are on gently sloping to moderately steep hills, ridges, and upper side slopes of the draw.

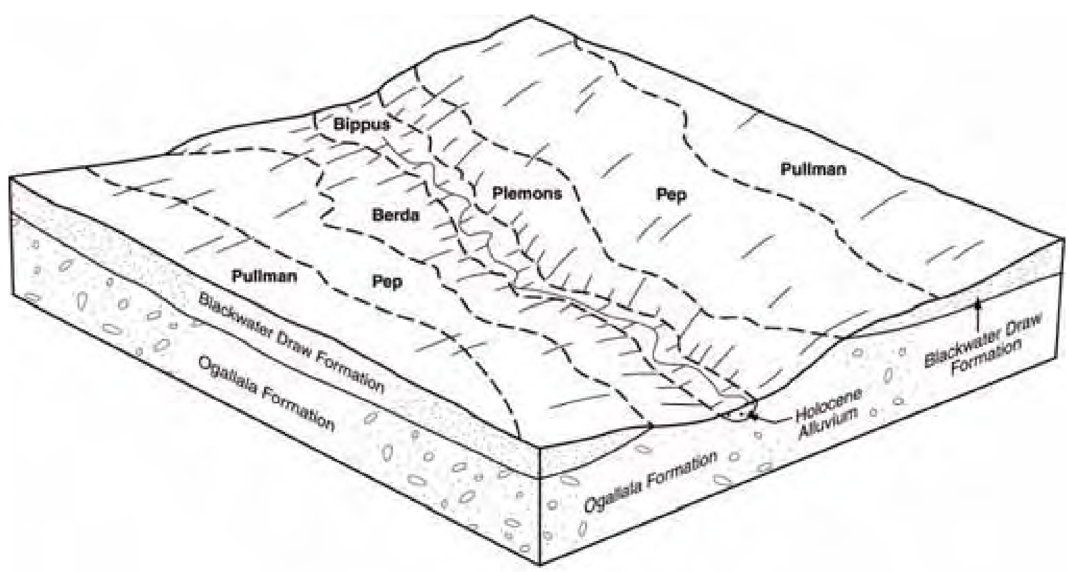

Figure 5.—Typical patterns of soils in the Pep-Plemons general soil map unit.

Soil Description

Pep

Landscape: Plateaus or tablelands
Landform: Playa slope; plain; backslope on draw
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 9 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—9 to 15 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—15 to 31 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—31 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 3e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass and midgrass prairie.

Plemons

Landscape: Breaks
Landform: Backslope on valley side; shoulder on erosion remnant
Parent material: Calcareous, loamy slope alluvium derived mainly from the upper part of the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; brown, moderately alkaline loam; violently effervescent
Btk1—6 to 13 inches; brown, moderately alkaline clay loam; about 3 percent films and threads of calcium carbonate; violently effervescent
Btk2—13 to 35 inches; brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; violently effervescent
Btk3—35 to 58 inches; light brown, moderately alkaline clay loam; about 30 percent threads and masses of calcium carbonate; violently effervescent
Btk4—58 to 76 inches; light brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; strongly effervescent
Btkb—76 to 80 inches; yellowish red, moderately alkaline clay; about 8 percent threads and masses of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.7 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: None specified
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077EY057TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses include vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Pep soils are primarily used for cropland. A few areas are used as improved pasture or rangeland. Plemons soils are used mainly as rangeland and habitat for wildlife. They are not used extensively as cropland or improved pasture.
Cropland management: Pep soils are moderately suited to cropland. The high carbonate content of the soil and moderate available water capacity are limitations. The most common crops grown are wheat, grain sorghum, cotton, and forage sorghum. Plemons soils are moderately suited to cropland. The slope, high carbonate content

of the soil, and moderate available water capacity are limitations. The most common crops grown on this soil are wheat and forage sorghum. The hazard of wind erosion is severe for both soils. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content of the soil and moderate available water capacity are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: These soils are moderately suited to most urban uses. Pep soils are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Plemons soils are very limited as a site for septic tank absorption fields, local roads and streets, or use as roadfill material. The restricted permeability and low soil strength are major limitations. Restricted permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades in both soils.

Recreational development: Pep soils are moderately suited to most recreational uses. They are very limited as a site for golf fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation. Plemons soils are well suited to most recreational uses.

Wildlife habitat: Wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

5. Pantex

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico

Geomorphic setting: This map unit occurs in the north central and northeastern part of the county above north Palo Duro Creek. The landscape consists of nearly level plains with numerous playa basins.

Map Unit Composition

Pantex and similar soils: 86 percent
Contrasting soils: 14 percent

This map unit makes up 42,234 acres or about 4 percent of the county. It is about 86 percent Pantex soils, and 14 percent soils of minor extent. The minor soils in this map unit are the Lofton, McLean, Pep, Pullman, and Randall soils. Lofton soils are on nearly level playa steps within large playa basins, or along shallow drainageways. The McLean and Randall soils are on the nearly level floor of playa basins. Pep soils are on very gently sloping or gently sloping plains and playa slopes. Pullman soils are on nearly level or very gently sloping plains on positions similar to those of the Pantex soils.

Soil Description

Pantex

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 7 inches; very dark grayish brown, slightly alkaline silty clay loam
Bt1—7 to 20 inches; very dark grayish brown, moderately alkaline silty clay
Bt2—20 to 34 inches; brown, moderately alkaline silty clay
Bt3—34 to 49 inches; brown, moderately alkaline silty clay loam; about 1 percent threads of calcium carbonate; strongly effervescent
Bt4—49 to 71 inches; brown, moderately alkaline silty clay loam; about 1 percent films and threads of calcium carbonate; slightly effervescent
Btk—71 to 80 inches; reddish yellow, moderately alkaline silty clay loam; about 50 percent films, threads, and masses of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 10.2 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Pantex soils are used extensively for cropland. A few small areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown on this soil are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, and septic tank absorption fields. The high shrink-swell potential, low soil strength and restricted permeability are major limitations. Shrinking and swelling can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to most recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

6. Pep-Berda-Bippus

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Geomorphic setting: This map unit occurs in the southern part of the county on the slopes of Tierra Blanca and Frio Creeks and generally crosses in a westerly to easterly direction. The landscape consists of ancient, meandering stream channels that are incised into the surrounding plains. Pep soils occur on very gently sloping landscape positions that run parallel to draws. Berda soils occur on gently sloping to strongly sloping backslopes on scarps or valley sides. Bippus soils are on nearly level or very gently sloping flood plains in draws (fig. 6).

Map Unit Composition

Pep and similar soils: 26 percent
Berda and similar soils: 16 percent
Bippus and similar soils: 15 percent
Contrasting soils: 43 percent

This map unit makes up 37,138 acres, or about 4 percent of the county. It is about 27 percent Pep soils, 16 percent Berda soils, 15 percent Bippus soils, and 42 percent soils of minor extent. The minor soils in this map unit are the Kimberson, Mobeetie, Plemons, Potter, Pullman, and Veal soils, and the Borrow Pit miscellaneous areas. Kimberson soils occur mainly on nearly level to gently sloping uplands that are adjacent to the draw. Mobeetie, Veal, and Potter soils occur on gently sloping to moderately steep shoulder and backslope positions on side slopes of the draw. Plemons soils occur on gently sloping upper backslope and similar hillslope positions along the draw. Pullman soils are on nearly level plains. Also included are Borrow pits that range from 5 to 10 acres in size. These areas normally occur in the Potter and Kimberson soils and include small pits, trenches, and spoil heaps where caliche or gravel has been excavated for road construction.

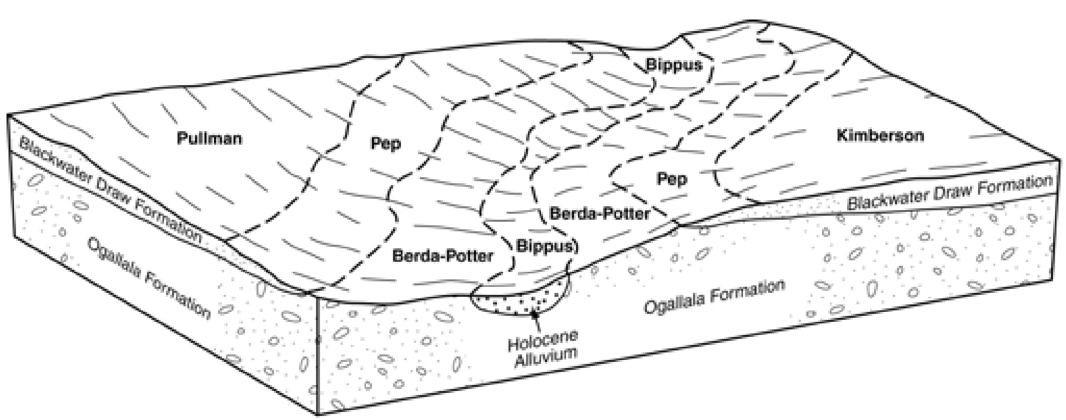

Figure 6.—Typical patterns of soils in the Pep-Berda-Bippus general soil map unit.

Pep

Landscape: Plateaus or tablelands
Landform: Plain; backslope on draw
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 9 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—9 to 15 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—15 to 31 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—31 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 3e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass and midgrass prairie.

Berda

Landscape: Breaks
Landform: Backslope on scarp; backslope on valley side
Parent material: Calcareous, loamy slope alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; light brown, moderately alkaline loam; violently effervescent
Bw—6 to 20 inches; light brown, moderately alkaline loam; violently effervescent

Bk1—20 to 36 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent
Bk2—36 to 52 inches; light reddish brown, moderately alkaline clay; loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent
Bk3—52 to 80 inches; light reddish brown, moderately alkaline sandy clay loam; about 5 percent films, threads, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 2 to 12 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse subrounded gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Hardland Slopes PE 25-36
Ecological site number: R077EY055TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses include vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Bippus

Landscape: Breaks
Landform: Ephemeral stream on draw
Parent material: Loamy alluvium of Holocene age

Typical Profile

Ap1—0 to 8 inches; brown, moderately alkaline clay loam
Ap2—8 to 14 inches; dark grayish brown, moderately alkaline sandy clay loam
Bw1—14 to 26 inches; brown, moderately alkaline sandy clay loam
Bw2—26 to 49 inches; brown, moderately alkaline sandy clay loam
Bw3—49 to 65 inches; strong brown, moderately alkaline sandy clay loam; about 2 percent films, threads, and concretions of calcium carbonate; slightly effervescent
Bk—65 to 80 inches; light yellowish brown, moderately alkaline fine sandy loam; about 10 percent threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 2 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: Occasional
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 2w
Land capability irrigated: 2w
Ecological site name: Draw PE 25-36
Ecological site number: R077EY052TX
Typical vegetation: The potential natural plant community is dominantly midgrasses with lesser amounts of both tall and shortgrass species. A few forbs occur along with a few woody plants. The dominant species are western wheatgrass, vine mesquite, and sideoats grama. Blue grama and buffalograss make up most of the shortgrass complement.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: The major soils in this map unit are not extensively cultivated and most areas are in native rangeland. A few small areas of Bippus and Pep soils are used as cropland or improved pasture. Most of the Berda soils are used primarily as native rangeland or wildlife habitat.
Cropland management: Pep soils are moderately suited to cropland. The moderate available water capacity and high carbonate content of the soil are limitations. The most common crops grown are wheat, grain sorghum, and forage sorghum. Berda soils are poorly suited to cropland. The slope, runoff, and available water capacity are major limitations. Bippus soils are not extensively used as cropland. Most areas are so narrow that use as cropland is limited and occasional flooding is a hazard. The hazard of erosion is severe for Pep and Berda soils. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses and midgrasses, which produce moderate amounts of forage. The slope, runoff, available water capacity, and carbonate content of the soil are limitations. The hazard of wind erosion is severe for the Pep and Berda soils. Bippus soils are well suited to rangeland.

Native plants yield high amounts of forage. Occasional flooding is a minor limitation. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Pep and Berda soils are moderately suited to most urban uses. Pep soils are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Berda soils are very limited as a site for small commercial buildings or sewage lagoons. The slope is a major limitation. Bippus soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities and building site development. The low soil strength and occasional flooding are major limitations. Overcoming these limitations is difficult and costly.

Recreational development: These soils are moderately suited to most recreational uses. Pep soils are very limited as a site for golf fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation. Berda soils are very limited as a site for playgrounds. The slope is a major limitation. Bippus soils are very limited as a site for camp areas unless protected from the hazard of flooding. The season, duration, and frequency of flooding should be considered in planning playgrounds and other recreational areas.

Wildlife habitat: For the Pep soils wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The potential for wind and water erosion is severe for the Berda soils. Moderately arid conditions, which can limit plant growth necessary for good habitat, are also a minor limitation for these soils. For the Bippus soils occasional flooding is a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

7. Quay-Glenrio-Tucumcari

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.

Geomorphic setting: This map unit occurs in the northwestern part of the county. The landscape consists of broad, nearly level to moderately steep plains and valleys. Quay soils are on moderately sloping hillslopes and alluvial fans. The Glenrio soils are on moderately sloping to moderately steep hillslopes, interfluves, and ridges. Tucumcari soils are on nearly level alluvial flats, alluvial fans, and swales (fig. 7).

Map Unit Composition

Quay and similar soils: 54 percent
Glenrio and similar soils: 17 percent
Tucumcari and similar soils: 10 percent
Contrasting soils: 19 percent

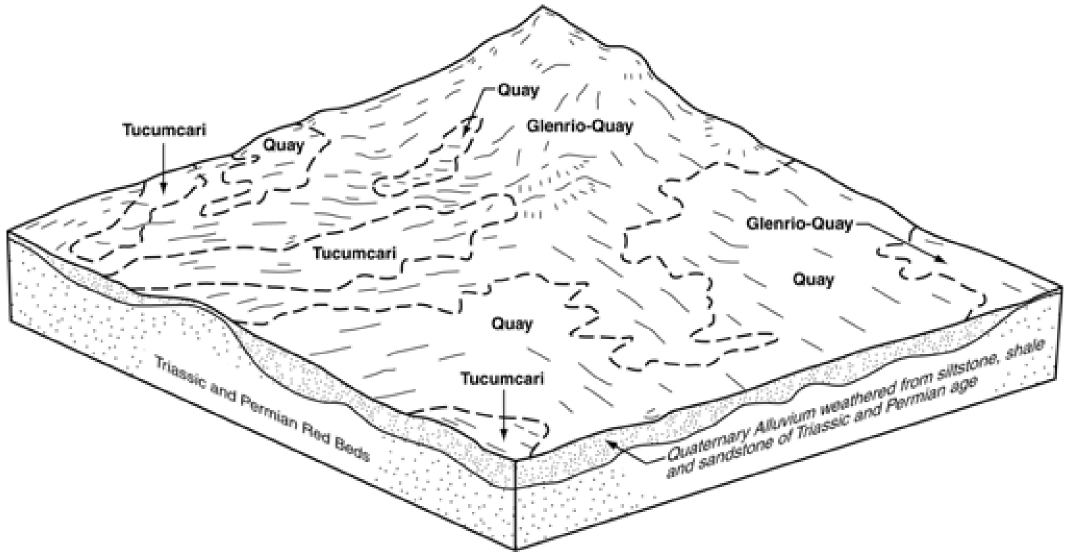

Figure 7.—Typical patterns of soils in the Quay-Glenrio-Tucumcari general soil map unit.

This map unit makes up 28,832 acres or about 3 percent of the county. It is about 54 percent Quay soils, 17 percent Glenrio soils, 10 percent Tucumcari soils, and 19 percent soils of minor extent. The minor soils in this map unit are Berwolf, Ima, Lacoca, Minneosa, Mobeetie, Redona, and Veal soils. Also included are miscellaneous areas of rock outcrop or rough broken land. Berwolf soils are on very gently sloping plains and hillslopes. Ima soils are on very gently to gently sloping plains, hillslopes, and alluvial fans. Lacoca soils are on very gently to moderately sloping ridgetops, hillslopes, and erosion remnants. Minneosa soils are on narrow and nearly level drainageways and stream channels. Mobeetie soils are on moderately sloping to moderately steep footslopes and alluvial fans. Redona soils are on very gently sloping or gently sloping plains, valley slopes, and alluvial fans. Veal soils are on moderately sloping to moderately steep backslopes and upper footslopes.

Soil Description

Quay

Landscape: Breaks
Landform: Footslope on alluvial fan; hillslope
Parent material: Calcareous, loamy alluvium weathered from sandstone and siltstone of Triassic and Permian age.

Typical Profile

A1—0 to 3 inches; reddish brown, moderately alkaline loam; slightly effervescent
A2—3 to 9 inches; light reddish brown, moderately alkaline loam; slightly effervescent
Bw—9 to 19 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bk—19 to 26 inches; reddish brown, moderately alkaline clay loam; about 30 percent masses and nodules of calcium carbonate; violently effervescent
BCk1—26 to 36 inches; light brown, moderately alkaline clay loam; about 25 percent masses and nodules of calcium carbonate; violently effervescent
BCk2—36 to 80 inches; pinkish gray, moderately alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.8 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 4e
Ecological site name: Loamy PE 25-31
Ecological site number: R070EY663TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses and midgrasses and only a few woody species. The dominant grass species is usually blue grama. Galleta and buffalograss are next in importance. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Glenrio

Landscape: Breaks
Landform: Shoulder on divide; summit on ridge; backslope on hillslope
Parent material: Clayey slope alluvium over residuum weathered from shale and siltstone of Triassic age.

Typical Profile

A—0 to 4 inches; reddish brown, moderately alkaline clay; slightly effervescent
Bw—4 to 14 inches; reddish brown, moderately alkaline clay; strongly effervescent
Cr—14 to 60 inches; red shale bedrock; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 15 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 4 percent coarse very angular gravel, 0 to 5 percent coarse subrounded gravel
Depth to restrictive feature: Bedrock (paralithic), 10 to 20 inches
Slowest permeability class in the soil profile: Slow above the bedrock
Permeability of restrictive feature: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches

Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Red Shale PE 25-31
Ecological site number: R070EY664TX
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses. Vegetation consists of sparse stands of blue grama, little bluestem, sideoats grama, buffalograss, galleta, and perennial threeawn. A moderate amount of forbs and shrubs are also present such as broom snakeweed, threeawn, catclaw acacia, dalea, prickly pear, saltbush, and mesquite.

Tucumcari

Landscape: Breaks
Landform: Rise on alluvial fan; talf on alluvial flat; dip on swale
Parent material: Calcareous, clayey alluvium derived from sandstone and shale of Triassic and Permian age.

Typical Profile

A—0 to 5 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Btk1—5 to 16 inches; reddish brown, moderately alkaline clay; about 3 percent disseminated calcium carbonate; strongly effervescent
Btk2—16 to 30 inches; reddish brown, moderately alkaline clay; about 3 percent disseminated calcium carbonate; strongly effervescent
Btk3—30 to 45 inches; reddish brown, moderately alkaline clay; about 2 percent threads of calcium carbonate; strongly effervescent
Bk—45 to 80 inches; reddish brown, moderately alkaline clay loam; about 2 percent threads of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4s
Land capability irrigated: None specified
Ecological site name: Clayey PE 25-31
Ecological site number: R070XB662NM
Typical vegetation: The potential natural plant community for this site is shortgrasses and midgrasses with a few forbs. Very few woody plants occur except occasional cholla. It is a shortgrass prairie. The most prevalent grasses are tobosa, alkali sacaton, blue grama, and buffalograss with tobosa being most prevalent.

Additional information specific to the components of this map unit is available in the "Table" section.

Use and Management

Major land uses: These soils are used primarily as rangeland and habitat for wildlife. They are not used for cropland or improved pasture in this county.
Cropland management: Quay and Tucumcari soils are moderately suited to cropland. The arid conditions are a major limitation. Glenrio soils are poorly suited to cropland. The slope, depth to bedrock, droughtiness, and very low available water capacity are major limitations. The hazard of erosion is severe for these soils.
Rangeland management: For the Quay and Tucumcari soils native plants are dominantly shortgrasses and midgrasses, which produce moderate amounts of forage. For the Glenrio soils native plants yield low amounts of forage. The slope, shallow depth to bedrock, very low available water capacity, and very high runoff are major limitations. The hazard of erosion is severe for these soils. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: Quay soils are moderately suited to most urban uses. They are very limited as a site for local roads and streets because of low soil strength and somewhat limited as a site for sewage lagoons because of slope. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Glenrio soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities or building site development. The slope, depth to soft bedrock, droughtiness, high clay content and shrink-swell potential, and low soil strength are major limitations. Overcoming many of these limitations is difficult and costly. Tucumcari soils are moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, and septic tank absorption fields. The high shrink-swell potential, low soil strength and restricted permeability are major limitations. Shrinking and swelling can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion protection or by using galvanized steel.

Recreational development: Quay soils are moderately suited to most recreational uses. They are very limited as a site for playgrounds because of slope. Glenrio soils are poorly suited to most recreational uses. They are very limited as a site for camp areas, picnic areas, playgrounds, and golf fairways. The slope, depth to bedrock, very low available water capacity, high clay content, and droughtiness are major limitations. Tucumcari soils are well suited to most recreational uses.
Wildlife habitat: The shallow rooting depth, clay content, and slow percolation of Glenrio soils, and the arid conditions of all the soils are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

8. Plemons-Potter-Mobeetie

Map Unit Setting

General location: Southern High Plains Breaks of western Texas and eastern New Mexico
Geomorphic setting: This map unit occurs in the northwest part of the county along the Southern High Plains Breaks in a long band about 1 mile wide. It is between the smoother tableland to the east and the low-lying plains and valleys to the west. The landscape consists of gently sloping upland and strongly sloping to steep breaks with some areas of nearly vertical, buff-colored cliffs and steep, gravelly slopes. The Plemons soils are on gently sloping valley sides or summits on divides. Mobeetie soils occur on moderately sloping to steep scarps or hillslopes. Potter soils are on moderately sloping to steep scarps or hillslopes (fig. 8).

Map Unit Composition

Plemons and similar soils: 30 percent
Potter and similar soils: 26 percent
Mobeetie and similar soils: 22 percent
Contrasting soils: 22 percent

This map unit makes up 17,329 acres or about 2 percent of the county. It is about 30 percent Plemons soils, 26 percent Potter soils, 22 percent Mobeetie soils, and 22 percent soils of minor extent. The minor soils in this map unit are the Berda, Pep, Quay, and Veal soils. Berda and Veal soils are on very gently sloping to moderately steep backslopes and upper side slopes below the escarpment. The Glenrio soils are on moderately sloping to moderately steep hillslopes, scarp slopes, and low ridges. Pep soils are on nearly level and very gently sloping plains. Quay soils are on moderately sloping hillslopes and alluvial fans. Areas of rock outcrop occur on narrow, very steep bluffs or ledges along the edge of the escarpment.

Soil Description

Plemons

Landscape: Breaks
Landform: Summit on divide; shoulder on erosion remnant; backslope on valley side
Parent material: Calcareous, loamy slope alluvium derived mainly from the upper part of the Ogallala Formation of Miocene-Pliocene age.

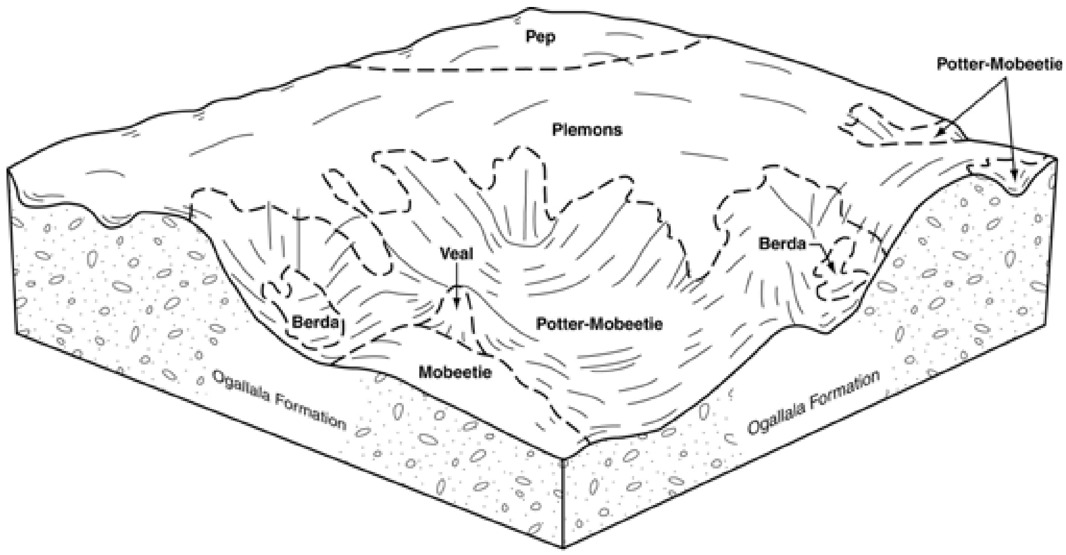

Figure 8.—Typical patterns of soils in the Plemons-Potter-Mobeetie general soil map unit.

Typical Profile

A—0 to 6 inches; brown, moderately alkaline loam; violently effervescent
Btk1—6 to 13 inches; brown, moderately alkaline clay loam; about 3 percent films and threads of calcium carbonate; violently effervescent
Btk2—13 to 35 inches; brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; violently effervescent
Btk3—35 to 58 inches; light brown, moderately alkaline clay loam; about 30 percent threads and masses of calcium carbonate; violently effervescent
Btk4—58 to 76 inches; light brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; strongly effervescent
Btkb—76 to 80 inches; yellowish red, moderately alkaline clay; about 8 percent threads and masses of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.7 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: None specified
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077EY057TX
Typical vegetation: This is a transitional site dominated by shortgrasses with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses include vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Potter

Landscape: Breaks
Landform: Shoulder on hillslope; Shoulder on scarp
Parent material: Calcareous, loamy alluvium derived from the upper part of the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam; about 22 percent moderately cemented to strongly cemented calcium carbonate fragments; strongly effervescent
A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately cemented to strongly cemented calcium carbonate fragments; violently effervescent
Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately cemented to strongly cemented calcium carbonate fragments; violently effervescent
BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments 1 to 3 inches across; violently effervescent
BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments 1 to 6 inches across; violently effervescent
BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 8 to 30 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent coarse subangular cobbles
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: High
Annual flooding: None

Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Mobeetie

Landscape: Breaks
Landform: Backslope on hillslope; backslope on scarp slope
Parent material: Calcareous, loamy sediments derived from the upper part of the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 8 inches; grayish brown, moderately alkaline fine sandy loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Bw—8 to 25 inches; light brown, moderately alkaline fine sandy loam; about 2 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bk—25 to 41 inches; pink, moderately alkaline fine sandy loam; about 4 percent films, threads, and nodules of calcium carbonate; violently effervescent
BC—41 to 80 inches; pink, moderately alkaline fine sandy loam; about 3 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 8 to 45 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7e
Land capability irrigated: None specified
Ecological site name: Mixedland Slopes PE 25-36
Ecological site number: R077EY061TX

Typical vegetation: This is a midgrass and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Plemons soils are used primarily as rangeland and habitat for wildlife. They are not used extensively as cropland or improved pasture. Potter and Mobeetie soils are used as rangeland and wildlife habitat.

Cropland management: Plemons soils are moderately suited to cropland. The high carbonate content of the soil and moderate available water capacity are limitations. The most common crops grown on this soil are wheat and forage sorghum. The hazard of wind erosion is severe. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity. Potter and Mobeetie soils are poorly suited to cropland. The steep slope, droughtiness, high runoff, and low available water capacity are major limitations. The hazard of wind and water erosion is severe.

Rangeland management: In the Plemons soils native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. In the Potter and Mobeetie soils some areas are inaccessible to livestock because of the steep slope. Native plants yield low amounts of forage. The high carbonate content and very low available water capacity is a major limitation for Potter soils. The slope and runoff is a limitation for both soils. The hazard of wind and water erosion is severe. The main concerns in management for these soils are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Plemons soils are moderately suited to most urban uses. They are very limited as sites for septic tank absorption fields, roads and streets, or use as roadfill material. The restricted permeability and low soil strength are major limitations. Restricted permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Potter and Mobeetie soils are poorly suited to urban uses. They are very limited as sites for sanitary facilities or building site development. The slope, seepage, droughtiness, gravel, and carbonate content of the soil are major limitations. Overcoming many of these limitations is difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Recreational development: Plemons soils are well suited to recreational uses. Potter and Mobeetie soils are poorly suited to most recreational uses. The steep slope, gravel content, carbonate content, and low available water capacity of the soil are major limitations.

Wildlife habitat: In the Plemons soils wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation. In the Potter and Mobeetie soils arid conditions and low available water capacity are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

9. Estacado-Pullman

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico

Geomorphic setting: This map unit is in the southeastern part of the county south of Tierra Blanca Creek. The landscape consists of broad, nearly level plains and numerous intermittent playa depressions (fig. 9).

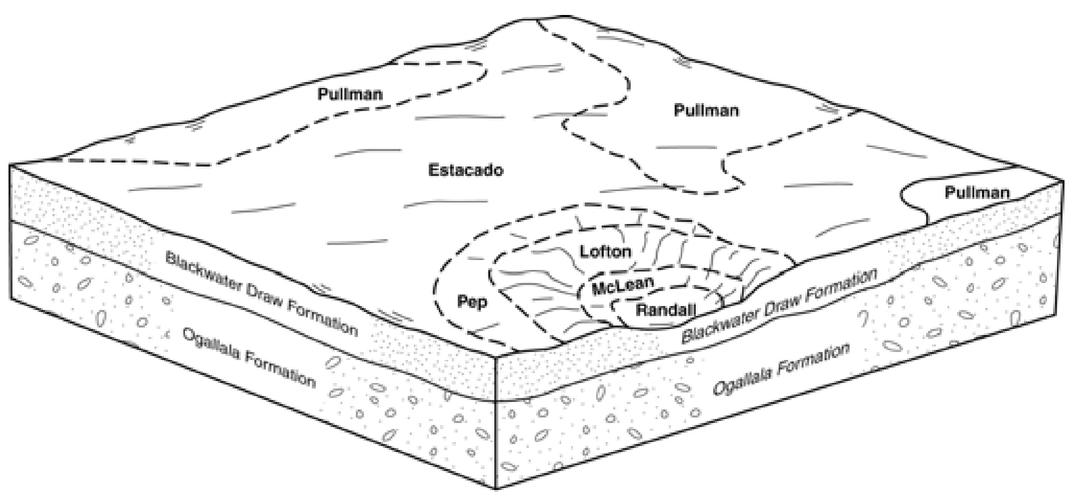

Figure 9.—Typical patterns of soils in the Estacado-Pullman general soil map unit.

Map Unit Composition

Estacado and similar soils: 53 percent
Pullman and similar soils: 28 percent
Contrasting soils: 19 percent

This map unit makes up 9,786 acres or about 1 percent of the county. It is about 53 percent Estacado soils, 28 percent Pullman soils, and 19 percent soils of minor extent. The minor soils in this map unit are the Kimberson, Lofton, McLean, Olton, Pep, and Randall soils. Kimberson soils are on very gently sloping and slightly convex plains. Lofton soils are on nearly level playa steps or shallow drainageways. The McLean soils are on the nearly level floor of playa depressions. Olton soils are on nearly level or very gently sloping landscape positions similar to those of the Estacado and Pullman soils. Pep soils are on very gently sloping plains and playa slopes. Randall soils are on the nearly level floor of playa basins.

Soil Description

Estacado

Landscape: Plateaus
Landform: Plain
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 6 inches; dark grayish brown, moderately alkaline clay loam; strongly effervescent
Bt1—6 to 19 inches; brown, moderately alkaline clay loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bt2—19 to 38 inches; brown, moderately alkaline clay loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Btk1—38 to 50 inches; pink, moderately alkaline clay loam; about 40 percent films and masses of calcium carbonate; violently effervescent

Btk2—50 to 80 inches; pinkish white, moderately alkaline clay loam; about 35 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Pullman

Landscape: Plateaus or tablelands
Landform: Plain; playa slope
Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 5 inches; brown, neutral clay loam
Bt1—5 to 18 inches; brown, slightly alkaline clay
Bt2—18 to 33 inches; dark brown, slightly alkaline clay; slightly effervescent
Btk1—33 to 52 inches; brown, moderately alkaline clay; about 2 percent films, threads, concretions, and nodules of calcium carbonate; strongly effervescent
Btk2—52 to 66 inches; strong brown, moderately alkaline clay about 25 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—66 to 80 inches; reddish yellow, moderately alkaline clay loam; about 40 percent masses, concretions, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.8 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: The major soils are extensively cultivated but a few areas are still in native rangeland.

Cropland management: This soil is well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The hazard of wind erosion is severe for Estacado soils. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Estacado soils are well suited to most urban uses. They are very limited as a site for construction of roads and streets or use as roadfill material. The low soil strength is a major limitation. Stabilizing, strengthening, or replacing the base material can overcome these restrictions. Pullman soils are moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, septic tank absorption fields, trench sanitary landfills, and use as daily cover for landfills. The high shrink-swell potential, low soil strength, restricted permeability, and high clay content of the soil are major limitations. Shrinking and swelling can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential by using galvanized steel.

Recreational development: These soils are well suited to most recreational uses.

Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

10. Kimberson-Pep-Potter

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico

Geomorphic setting: This map unit is south of Tierra Blanca Creek in the southeastern part of the county. The landscape consists of nearly level or very gently sloping plains with low convex knolls or ridges and gently sloping to strongly sloping drainageways. Kimberson soils occur on nearly level and very gently sloping plains. Pep soils are on nearly level and very gently sloping plains, playa slopes, or backslopes on draws. Potter soils are on gently sloping to strongly sloping crests of draws or scarps (fig. 10).

Map Unit Composition

Kimberson and similar soils: 46 percent
Pep and similar soils: 28 percent
Potter and similar soils: 18 percent
Contrasting soils: 8 percent

This map unit makes up 8,301 acres or less than 1 percent of the county. It is about 46 percent Kimberson soils, 29 percent Pep soils, 19 percent Potter soils, and 6 percent soils of minor extent. The minor soils in this map unit are the Estacado, Mobeetie, Plemons, and Veal soils. Estacado soils are on nearly level plains. The Mobeetie, Plemons, and Veal soils are on gently sloping to moderately steep backslopes and side slopes along Tierra Blanca Creek.

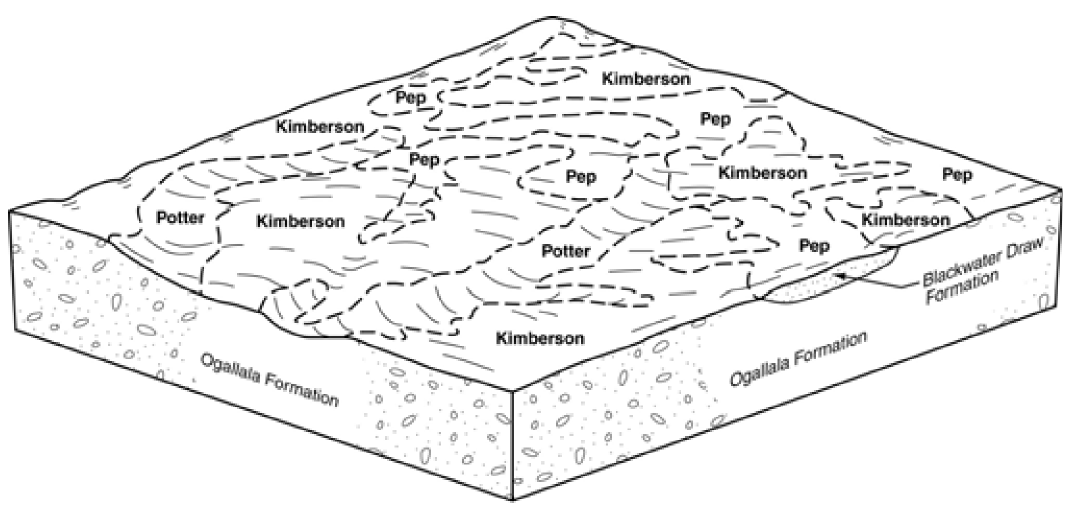

Figure 10.—Typical patterns of soils in the Kimberson-Pep-Potter general soil map unit.

Soil Description

Kimberson

Landscape: Plateau
Landform: Plain
Parent material: Calcareous, loamy eolian alluvium from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 5 inches; dark grayish brown, moderately alkaline gravelly loam; 15 percent gravel- and cobble-size petrocalcic fragments; strongly effervescent
A2—5 to 11 inches; dark grayish brown, moderately alkaline very gravelly loam; 40 percent gravel- and cobble-size petrocalcic fragments; violently effervescent
Bkm—11 to 28 inches; white, petrocalcic; laminar in the upper part
Bk—28 to 64 inches; white and light gray, moderately alkaline extremely gravelly fine sandy loam; 85 percent gravel- and cobble-size petrocalcic fragments; violently effervescent
B'km—64 to 80 inches; white, petrocalcic; laminar in the upper part

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 20 percent very angular channers
Depth to restrictive feature: Petrocalcic, 4 to 20 inches
Slowest permeability class in the soil profile: Moderate above the petrocalcic
Permeability of restrictive feature: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 1.3 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077CY037TX
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Pep

Landscape: Plateaus or tablelands
Landform: Plain; playa slope; backslope on draw

Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 9 inches; reddish brown, moderately alkaline clay loam; strongly effervescent

Bw1—9 to 15 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent

Bw2—15 to 31 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent

Bk—31 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 3e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Potter

Landscape: Breaks
Landform: Shoulder on draw; shoulder on scarp
Parent material: Calcareous, loamy alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam about 22 percent moderately cemented to strongly cemented calcium carbonate fragments; strongly effervescent

A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent

Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately cemented to strongly cemented calcium carbonate fragments; violently effervescent

BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments 1 to 3 inches across; violently effervescent

BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments 1 to 6 inches across; violently effervescent

BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 20 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent subangular cobbles
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: High
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: The major soils are used mainly as native rangeland and wildlife habitat. Some areas of the Pep soils may be in cultivation.

Cropland management: Kimberson soils are poorly suited to cropland. The shallow rooting depth, very low available water capacity, and droughtiness are major limitations. The hazard of wind erosion is severe. Pep soils are moderately suited to cropland. The high carbonate content and moderate available water capacity are limitations. The hazard of wind erosion is severe. The most common crops grown on

Pep soils are wheat, grain sorghum, cotton, and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity. Potter soils are poorly suited to cropland. The slope, very low available water capacity, carbonate content, droughtiness, shallow rooting depth, and very high runoff are major limitations.

Rangeland management: In the Kimberson soils native plants yield low amounts of forage. The depth to a cemented pan, very low available water capacity, and very high runoff are major limitations. In the Pep soils native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe for Kimberson and Pep soils. Potter soils are poorly suited to rangeland. Native plants yield low amounts of forage. The high carbonate content of the soil, very low available water capacity, slopes, and very high runoff is a major limitation. The main concerns in management for these soils are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Kimberson soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities and building site development. The depth to a cemented pan, carbonate content, and droughtiness is a major limitation. Overcoming many of these limitations is difficult and costly. Pep soils are moderately suited to most urban uses. They are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road sub-grades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Potter soils are poorly suited to urban uses. They are very limited for use as sanitary facilities and building site development. The slopes, droughtiness, gravel, and carbonate content is a major limitation. Overcoming many of these limitations is difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in Kimberson or Potter soils. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle conditions.

Recreational development: Kimberson soils are poorly suited to most recreational uses. They are very limited as a site for golf fairways, playgrounds, camping areas, and picnic areas. The shallow depth to a cemented pan, very low available water capacity, droughtiness, gravel content, and carbonate content of the soil are major limitations. Pep soils are moderately suited to most recreational uses. They are very limited as a site for golf course fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation. Potter soils are poorly suited to most recreational uses. They are very limited as a site for golf course fairways and playgrounds. The gravel content, slope, low available water capacity, and carbonate content of the soil are major limitations. Other recreational use is somewhat limited because of the slope and dustiness.

Wildlife habitat: In the Kimberson soils the low available water capacity and slow percolation are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe. In the Pep soils wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation. In the Potter soils the low available water capacity and arid conditions are major limitations that restrict plant growth necessary for good habitat. The potential for water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

11. Redona-Ima-Berwolf

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.

Geomorphic setting: This map unit occurs in the northwestern part of the county. The landscape consists of gently undulating plains, hillslopes, and alluvial flats. Redona soils are on very gently sloping and gently sloping terraces, hillslopes, and alluvial fans. Ima soils are on very gently sloping and gently sloping stream terraces, alluvial fans, and hillslopes. Berwolf soils are on very gently sloping hillslopes and plains (fig. 11).

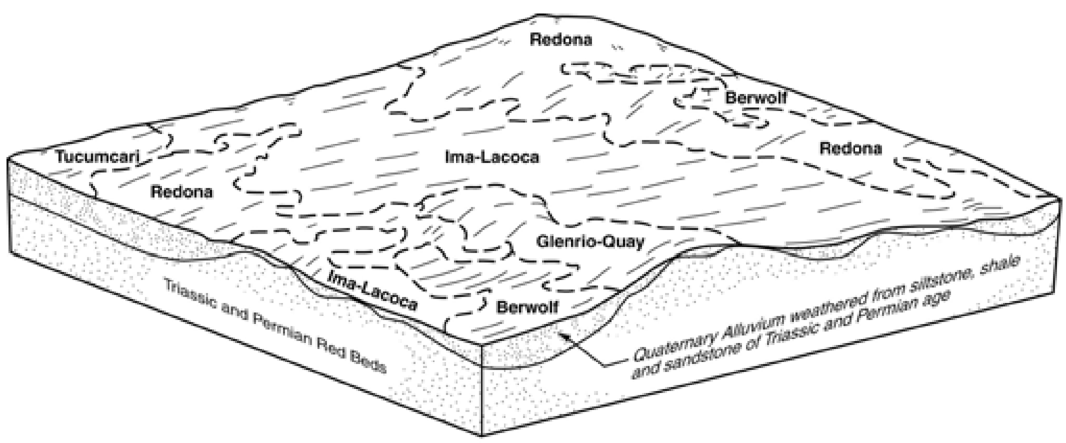

Figure 11.—Typical patterns of soils in the Redona-Ima-Berwolf general soil map units.

Map Unit Composition

Redona and similar soils: 38 percent
Ima and similar soils: 23 percent
Berwolf and similar soils: 21 percent
Contrasting soils: 18 percent

This map unit makes up 7,905 acres or less than 1 percent of the county. It is about 38 percent Redona soils, 23 percent Ima soils, 21 percent Berwolf soils, and 18 percent soils of minor extent. The minor soils in this map unit are Glenrio, Lacoca, Minneosa, Mobeetie, Quay, and Tucumcari soils. Glenrio soils are on moderately sloping to moderately steep hillslopes, scarp slopes, and low ridges. Lacoca soils are on very gently sloping to moderately sloping ridgetops, hillslopes, and erosion remnants. Minneosa soils are on nearly level or very gently sloping drainageways and narrow stream channels. Mobeetie soils are on gently sloping footslopes and alluvial fans. Quay soils are on very gently sloping to moderately sloping hillslopes and alluvial fans. Tucumcari soils are on nearly level plains and alluvial fans.

Soil Description

Redona

Landscape: Breaks
Landform: Footslope on alluvial fan; tread on terrace; summit on hillslope
Parent material: Loamy slope alluvium over calcareous residuum weathered from sandstone and shale of Triassic age.

Typical Profile

A—0 to 10 inches; reddish brown, slightly alkaline fine sandy loam
Bt1—10 to 24 inches; reddish brown, slightly alkaline sandy clay loam
Bt2—24 to 28 inches; reddish brown, slightly alkaline sandy clay loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bk1—28 to 50 inches; pink, strongly alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent
Bk2—50 to 80 inches; light reddish brown, moderately alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 4e
Ecological site name: Sandy Loam Pe 25-31
Ecological site number: R070XB054NM
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses with a smaller tallgrass complement. Midgrasses tend to dominate over most of the site with sideoats grama being the most prevalent midgrass species. Blue grama is the dominant shortgrass species and little bluestem the dominant tallgrass species. Small areas may occur within the site where blue grama is more prevalent. Woody plants are few but include yucca, catclaw acacia, and sand sage.

Ima

Landscape: Breaks
Landform: Footslope on stream terrace; toeslope on alluvial fan; backslope on hillslope
Parent material: Alluvium and eolian sediments weathered from sandstones and shales of Jurassic, Triassic, and Permian age.

Typical Profile

A1—0 to 5 inches; reddish brown, slightly alkaline loamy fine sand
A2—5 to 10 inches; reddish brown, moderately alkaline fine sandy loam
Bw—10 to 32 inches; light reddish brown, moderately alkaline fine sandy loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bk—32 to 40 inches; light reddish brown, moderately alkaline fine sandy loam; about 8 percent masses of calcium carbonate; violently effervescent
C—40 to 80 inches; reddish yellow, moderately alkaline very fine sandy loam; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: 1 to 5 percent fine subangular gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.5 inches (Moderate)
Natural drainage class: Well drained
Runoff: Very low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6c
Land capability irrigated: None specified
Ecological site name: Sandy Plains
Ecological site number: R070XB054NM
Typical vegetation: The potential natural plant community is a mixture of shortgrasses and midgrasses with a smaller tallgrass complement. Midgrasses tend to dominate over most of the site with sideoats grama being the most prevalent midgrass species.

Blue grama is the dominant shortgrass species and little bluestem the dominant tallgrass species. Small areas may occur within the site where blue grama is more prevalent. Woody plants are few but include yucca, catclaw acacia, and sand sage.

Berwolf

Landscape: Breaks
Landform: Tread on plain; flat on hillslope
Parent material: Sandy slope alluvium over residuum weathered from calcareous sandstone of Triassic age.

Typical Profile

A—0 to 11 inches; brown, slightly alkaline loamy fine sand
Bt1—11 to 20 inches; reddish brown, moderately alkaline fine sandy loam
Bt2—20 to 34 inches; yellowish red, moderately alkaline fine sandy loam; slightly effervescent
BCk1—34 to 45 inches; reddish yellow, moderately alkaline fine sandy loam; about 4 percent masses and nodules of calcium carbonate; violently effervescent
BCk2—45 to 80 inches; pink, moderately alkaline fine sandy loam; about 20 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Very low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6c
Land capability irrigated: None specified
Ecological site name: Sandy Plains
Ecological site number: R070XB055NM
Typical vegetation: This is a tallgrass climax. Nearly half of the grass component is composed of tallgrasses such as little bluestem and sand bluestem, along with taller dropseed species. The remainder is midgrasses and shortgrasses such as sideoats grama, sand dropseed, hooded windmillgrass, sand lovegrass, sand paspalum, fall witchgrass, hairy grama, needle and thread, and perennial threeawn. Sand sage, shinoak, and skunkbush make up the remaining woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used primarily as rangeland and habitat for wildlife. They are not used for cropland or improved pasture in this county.

Cropland management: These soils are moderately suited to cropland. The slope, droughtiness, arid conditions, and moderate available water capacity of the soils are limitations. The hazard of wind erosion is severe.

Rangeland management: Native plants produce moderate amounts of forage. The moderate available water capacity and droughtiness are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: Redona soils are well suited to most urban uses. Ima and Berwolf soils are moderately suited to most urban uses. They are very limited as a site for sewage lagoons. The hazard of seepage, which can contaminate aquifers, wells, and streams, is a major limitation. Lining the floor and sides of the sewage lagoon with relatively impervious material can minimize the potential for contamination. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: These soils are well suited to most recreational uses. The high sand content is a minor limitation for Ima soils.

Wildlife habitat: The arid conditions are a major limitation that can restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

Detailed Soil Map Units

The map units delineated on the detailed soil maps in 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.

A map unit delineation on a soil 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. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils 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 minor components that belong to taxonomic classes other than those of the major soils.

Most minor 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, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. 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 contrasting components are mentioned in the map unit descriptions. A few areas of minor components 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 minor components 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. If intensive use of small areas is planned, however, 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, Pep clay loam, 1 to 3 percent slopes, is a phase of the Pep 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. Berda-Potter complex, 2 to 12 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Mobeetie-Veal-Potter association, 5 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Drake soils, 1 to 8 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Borrow pits 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.

BcA—Bippus clay loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico
Major land resource area: 77E
Geomorphic setting: These soils are on nearly level or very gently sloping flood plains and valley floors that occur along Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Bippus and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Bippus soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Bippus are small soil areas that have a mollic epipedon less than 20 inches thick.

The contrasting soils are small areas of Berda, Minneosa, and Lofton soils. Berda soils are on higher landscape positions. Minneosa and Lofton soils are in landscape positions similar to those of the Bippus soil.

Soil Description

Bippus

Landscape: Breaks
Landform: Ephemeral stream on draw
Parent material: Loamy alluvium of Holocene age

Typical Profile

Ap1—0 to 8 inches; brown, moderately alkaline clay loam
Ap2—8 to 14 inches; dark grayish brown, moderately alkaline sandy clay loam
Bw1—14 to 26 inches; brown, moderately alkaline sandy clay loam
Bw2—26 to 49 inches; brown, moderately alkaline sandy clay loam
Bw3—49 to 65 inches; strong brown, moderately alkaline sandy clay loam; about 2 percent films, threads, and concretions of calcium carbonate; slightly effervescent
Bk—65 to 80 inches; light yellowish brown, moderately alkaline fine sandy loam; about 12 percent threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 2 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: Not present
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: Occasional
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 2w
Land capability irrigated: 2w
Ecological site name: Draw PE 25-36
Ecological site number: R077EY052TX
Typical vegetation: The potential natural plant community is dominantly midgrasses with lesser amounts of both tallgrass and shortgrass species. A few forbs occur along with a few woody plants. The dominant species are western wheatgrass, vine mesquite, and sideoats grama. Blue grama and buffalograss make up most of the shortgrass complement.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Bippus soils are used primarily as rangeland and habitat for wildlife. A few small areas are used as improved pasture or cropland.
Cropland management: These soils are not extensively used as cropland. Most areas are so narrow that use as cropland is limited, and occasional flooding is a hazard. Improved varieties of bermudagrass and bluestems are the major grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants yield large amounts of forage. Occasional flooding is a minor limitation. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable

perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: These soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities and building site development. The low soil strength and occasional flooding are major limitations. Overcoming these limitations is difficult and costly.

Recreational development: These soils are moderately suited to most recreational uses. They are very limited as a site for camp areas unless protected from the hazard of flooding. The season, duration, and frequency of flooding should be considered in planning playgrounds and other recreational areas.

Wildlife habitat: There are no major limitations for use as wildlife habitat. Occasional flooding is a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "**Use and Management**" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

BeD—Berda loam, 5 to 8 percent slopes

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico

Major land resource area: 77E

Geomorphic setting: These soils are on moderately sloping side slopes and backslopes occurring along the southern high plains breaks or similar hillslope positions along drainageways of Tierra Blanco and Palo Duro Creeks.

Map Unit Composition

Berda and similar soils: 85 percent

Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Berda soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Berda include small areas of Plemons soils, and soils similar to Berda that have a mollic epipedon. Included in mapping are small areas of Berda soils with a surface layer of very fine sandy loam and slopes of 8 to 12 percent.

The contrasting soils are small areas of Mobeetie, Potter, and Veal soils that occur on similar landscape positions.

Soil Description

Berda

Landscape: Breaks

Landform: Backslope on valley side; backslope on scarp

Parent material: Calcareous, loamy slope alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; light brown, moderately alkaline loam; violently effervescent

Bw—6 to 20 inches; light brown, moderately alkaline loam; violently effervescent

Bk1—20 to 36 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent

Bk2—36 to 52 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent
Bk3—52 to 80 inches; light reddish brown, moderately alkaline sandy clay loam; about 5 percent films, threads, and concretions of calcium carbonate; violently effervescent.

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse subrounded gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Hardland Slopes PE 25-36
Ecological site number: R077EY055TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats grama are next in importance. Other midgrasses are vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The slope, runoff, and moderate available water capacity of the soil are major limitations. The hazard of erosion is severe.
Rangeland management: Native plants are dominantly shortgrasses and midgrasses, which produce moderate amounts of forage. The moderate available water capacity and runoff are limitations. The hazard of erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are well suited for most urban uses. They are somewhat limited as a site for the construction of small commercial buildings, local roads and streets, sewage lagoons, or use as roadfill material. The slope and low soil strength are minor limitations.

Recreational development: This soil is well suited to most recreational uses. Dustiness is somewhat limiting. Recreational areas may require water or special surfacing material during dry periods to prevent excessive dustiness due to heavy foot traffic.
Wildlife habitat: Wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

BfB—Berwolf loamy fine sand, 1 to 3 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.
Major land resource area: 70B
Geomorphic setting: These soils are on very gently sloping hillslopes and plains that occur along the upper Pecos and Canadian valleys and plains in the northeastern corner of the county.

Map Unit Composition

Berwolf and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Berwolf soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Berwolf are Redona soils that occur on similar landscape positions. Also included in mapping are small areas of Berwolf soils with fine sandy loam surface texture or slopes less than 1 percent.

The contrasting soils are Glenrio, Ima, Lacoca, Tucumcari, and Quay soils. The Glenrio, Ima, and Lacoca soils occur on slightly higher landscape positions. Tucumcari soils are on lower landscape positions. The Quay soil occurs on similar landscape positions.

Soil Description

Berwolf

Landscape: Breaks
Landform: Tread on plain; flat on hillslope
Parent material: Sandy slope alluvium over residuum weathered from calcareous sandstone of Triassic age.

Typical Profile

A—0 to 11 inches; brown, slightly alkaline loamy fine sand
Bt1—11 to 20 inches; reddish brown, moderately alkaline fine sandy loam
Bt2—20 to 34 inches; yellowish red, moderately alkaline fine sandy loam; slightly effervescent
BCk1—34 to 45 inches; reddish yellow, moderately alkaline fine sandy loam; about 4 percent masses and nodules of calcium carbonate; violently effervescent
BCk2—45 to 80 inches; pink, moderately alkaline fine sandy loam; about 20 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Very low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6c
Land capability irrigated: None specified
Ecological site name: Sandy Plains
Ecological site number: R070XB055NM
Typical vegetation: This is a tallgrass climax. Nearly half of the grass component is composed of tallgrasses such as little and sand bluestem, along with taller dropseed species. The remainder is mid and shortgrasses such as sideoats grama, sand dropseed, hooded windmillgrass, sand lovegrass, sand paspalum, fall witchgrass, hairy grama, needle and thread, and perennial threeawn. Sand sage, shinoak, and skunkbush make up the remaining woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Berwolf soils are used primarily as rangeland and habitat for wildlife. These soils are not used for cropland or improved pasture in this county.
Cropland management: These soils are moderately suited to cropland. Arid conditions and the moderate available water capacity are limitations. The hazard of wind erosion is severe.
Rangeland management: Native plants yield moderate amounts of forage. Droughtiness and moderate available water capacity are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are moderately suited to urban uses. They are very limited as a site for sewage lagoons. The hazard of seepage, which can contaminate aquifers, wells, and streams, is a major limitation. Lining the floor and sides of the sewage lagoon with relatively impervious material can minimize the potential for contamination. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to recreational uses.

Wildlife habitat: Arid conditions and available water capacity are major limitations that restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

BP—Borrow pits

Map Unit Setting

General location: Southern High Plains of western Texas, Oklahoma, and eastern New Mexico
Major land resource area: 77C & 77E
Geomorphic setting: This miscellaneous land area is on breaks and plains and occurs in all parts of the county.

Map Unit Composition

Borrow pits and similar soils: 95 percent
Contrasting soils: 5

Based on field observations of the map unit during the survey, the best estimate is that the Borrow pits make up 95 percent of the map unit, and other soils make up 5 percent.

Other soils include small areas of Kimberson, Pep, Plemons, Potter, and Veal soils.

Soil Description

Borrow pits

Landscape: Breaks; plains
Parent material: Caliche mine spoil on earthy fill

Properties and Qualities

Slope: 0 to 45 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.4 inches (Very low)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Occasional
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 8s
Land capability irrigated: None specified
Ecological site name: Not specified
Ecological site number: Not specified
Typical vegetation: Not specified

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: This map unit consists of caliche and gravel pits that have been excavated for use mainly as road material. Borrow pits have steep vertical sidewalls, are 10 to 15 feet deep, and range from 5 to 50 acres in size. The exposed soil material in the pits is mainly caliche, gravel, and calcareous soil material.
Cropland management: These areas are poorly suited to cropland. The slope, droughtiness, very low available water capacity, high carbonate content, very high runoff, and low natural fertility are major limitations. The hazard of erosion is severe.
Rangeland management: The steep slope, very high runoff, low available water capacity, high carbonate content, low natural fertility, and ponding are major limitations. The hazard of erosion is severe.
Urban development: These areas are poorly suited to urban uses. They are very limited for use as sanitary facilities and building site development. The slope, ponding, restricted permeability, droughtiness, gravel, and carbonate content are major limitations.
Recreational development: These areas are poorly suited to recreational uses. They are very limited because of the slope, droughtiness, gravel content, carbonate content, and hazard of ponding are major limitations.
Wildlife habitat: The low available water capacity, surface rock fragments, arid conditions, and ponding are major limitations which restrict plant growth necessary for good habitat. Occasionally these areas used by transient wildlife that use water here following rainy periods or for cover; however, since there is little or no vegetation, this use is very limited. These areas are severely limited for other uses.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

BpD—Berda-Potter complex, 2 to 12 percent slopes

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico
Major land resource area: 77E
Geomorphic setting: These soils occur around Lake Garcia in the western part of the county and on similar hillslope positions along drainageways of Tierra Blanca and Palo Duro creeks. Berda soils are on very gently to strongly sloping side slopes and backslopes of scarps and valley sides. Potter soils are on very gently to strongly sloping shoulder slopes of scarps or draws (fig. 12).

Map Unit Composition

Berda and similar soils: 55 percent
Potter and similar soils: 30 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Berda and similar soils make up 56 percent of the map unit, the Potter and similar soils make up 29 percent of the map unit, and the contrasting soils make up 15 percent.

Figure 12.—Caliche pits are common in the Potter component of the Berda-Potter complex, 2 to 12 percent slopes.

The soils similar to Berda are small areas of Plemons soils, and soils that have a mollic epipedon. The soils similar to Potter are small areas of Friona and Kimberson soils.

The contrasting soils occur as small areas of Bippus, Glenrio, Mobeetie, Quay, and Veal. Also included in mapping are borrow pits less than 3 acres in size, U-shaped gullies, areas of rock outcrop, and slopes of 13 to 20 percent.

Soil Description

Berda

Landscape: Breaks
Landform: Backslope on valley side; backslope on scarp
Parent material: Calcareous, loamy slope alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; light brown, moderately alkaline loam; violently effervescent
Bw—6 to 20 inches; light brown, moderately alkaline loam; violently effervescent
Bk1—20 to 36 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent
Bk2—36 to 52 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent
Bk3—52 to 80 inches; light reddish brown, moderately alkaline sandy clay loam; about 5 percent films, threads, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 2 to 12 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse subrounded gravel

Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Hardland Slopes PE 25-36
Ecological site number: R077EY055TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses includes vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Potter

Landscape: Breaks
Landform: Shoulder on draw; shoulder on scarp
Parent material: Loamy alluvium from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam; about 22 percent moderately to strongly cemented calcium carbonate fragments; strongly effervescent
A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments, 1 to 3 inches across; violently effervescent
BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent
BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 2 to 12 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent coarse subangular gravel
Depth to restrictive feature: None

Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: High
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The carbonate content, very high runoff, and droughtiness of Potter soils, and the slope of both soils are major limitations. The hazard of erosion is severe.
Rangeland management: In the Berda soils native plants are dominantly short and midgrasses, which produce moderate amounts of forage. The slope, moderate runoff, and moderate available water capacity are limitations. In the Potter soils native plants yield low amounts of forage. The high carbonate content of the soil, very low available water capacity, slopes, and very high runoff is a major limitation. The hazard of erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: Berda soils are moderately suited to most urban uses. They are very limited as a site for small commercial buildings or sewage lagoons. The slope is a major limitation. Potter soils are poorly suited to most urban uses. They are very limited as a site for small commercial buildings, sewage lagoons, lawns and landscaping, or use as daily cover for landfills. The slope, high carbonate content, high gravel content, and droughtiness of the soil are major limitations. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.
Recreational development: These soils are moderately suited to most recreational uses. Berda soils are very limited for use as playgrounds. The slope is a major limitation. The Potter soil is very limited for use as playgrounds and golf course fairways. The slope, droughtiness, high carbonate content and high gravel content of the soil is a major limitation. Both soils are somewhat limited because of dustiness. Recreational

areas may require water or special surfacing material during dry periods to prevent excessive dustiness due to heavy foot traffic.

Wildlife habitat: Arid conditions and low available water capacity are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

BVD—Berda-Veal association, 3 to 8 percent slopes

Map Unit Setting

General location: Southern High Plains; Breaks of western Texas and eastern New Mexico

Major land resource area: 77E

Geomorphic setting: These soils are on gently to moderately sloping upper backslopes and on side slopes that occur along the southern high plains breaks in the northwestern part of the county.

Map Unit Composition

Berda and similar soils: 60 percent

Veal and similar soils: 20 percent

Contrasting soils: 20 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Berda and similar soils make up 61 percent of the map unit, the Veal and similar soils make up 24 percent of the map unit, and the contrasting soils make up 15 percent.

The soils similar to Berda are small areas of Plemons soils, and soils similar to Berda that have a mollic epipedon. The soils similar to Veal are small areas of Mobeetie soils.

The contrasting soils occur as small areas of Glenrio, Potter, and Quay soils that occur on similar landscape positions. Also included in mapping are U-shaped gullies, areas of rock outcrop, and slopes of 8 to 12 percent.

Soil Description

Berda

Landscape: Breaks

Landform: Back slope on valley side; back slope on scarp

Parent material: Calcareous, loamy slope alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; light brown, moderately alkaline loam; violently effervescent

Bw—6 to 20 inches; light brown, moderately alkaline loam; violently effervescent

Bk1—20 to 36 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent

Bk2—36 to 52 inches; light reddish brown, moderately alkaline clay loam; about 3 percent threads and concretions of calcium carbonate; violently effervescent

Bk3—52 to 80 inches; light reddish brown, moderately alkaline sandy clay loam; about 5 percent films, threads, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse subrounded gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.9 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Hardland Slopes PE 25-36
Ecological site number: R077EY055TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses includes vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Veal

Landscape: Breaks
Landform: Summit on knoll; backslope on valley side; back slope on hillslope
Parent material: Calcareous, loamy colluvium over alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 8 inches; brown, moderately alkaline fine sandy loam; about 1 percent nodules of calcium carbonate; violently effervescent
Bk1—8 to 17 inches; pale brown, moderately alkaline sandy clay loam; about 20 percent nodules of calcium carbonate; violently effervescent
Bk2—17 to 36 inches; pink, moderately alkaline sandy clay loam; about 50 percent masses and nodules of calcium carbonate; violently effervescent
Bk3—36 to 80 inches; pink, moderately alkaline sandy clay loam; about 50 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse very angular gravel, 0 to 4 percent coarse subrounded gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches

Sodicity: Not sodic within 40 inches
Available water capacity: About 6.8 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The slope, runoff, droughtiness, and high carbonate content of the soil are limitations. The hazard of erosion is severe.
Rangeland management: Native plants yield moderate amounts of forage. The moderate available water capacity, moderate runoff, and high carbonate content of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: Berda soils are well suited for most urban uses. They are somewhat limited as a site for the construction of small commercial buildings, local roads and streets, or sewage lagoons. The slope and low soil strength are minor limitations. Veal soils are moderately suited for most urban uses. They are very limited as a site for lawns and landscaping or use as daily cover for landfills. The high carbonate content and moderate available water capacity of the soil are major limitations that can limit plant growth necessary for healthy lawns and landscaping.
Recreational development: These soils are moderately suited to most recreational uses. Berda soils are very limited for use as playgrounds. The slope is a major limitation. The Veal soil is very limited for use as playgrounds and golf course fairways. The slope and high carbonate content of the soil is a major limitation.
Wildlife habitat: Arid conditions and low available water capacity are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

DRC—Drake soils, 1 to 8 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on very gently to moderately sloping linear or curvilinear dunes that occur adjacent to playa basins.

Map Unit Composition

Drake and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Drake soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Drake are small areas of Portales soils that occur on slightly lower landscape positions. Also included are small areas of Drake soils that have slopes of 8 to 12 percent.

The contrasting soils are small areas Estacado, Olton, Pep, and Pullman soils that occur on lower landscape positions.

Soil Description

Drake

Landscape: Plateau
Landform: Playa dune
Parent material: Calcareous, loamy eolian sediments of Quaternary age.

Typical Profile

A1—0 to 5 inches; pale brown, moderately alkaline loam; strongly effervescent
A2—5 to 15 inches; light brownish gray, moderately alkaline fine sandy loam; about 1 percent nodules of calcium carbonate; strongly effervescent
Bk1—15 to 28 inches; light brownish gray, moderately alkaline sandy clay loam; about 2 percent threads and nodules of calcium carbonate; violently effervescent
Bk2—28 to 43 inches; light brownish gray, moderately alkaline loam; about 2 percent threads and nodules of calcium carbonate; violently effervescent
Bk3—43 to 69 inches; light brownish gray, moderately alkaline loam; about 2 percent threads and nodules of calcium carbonate; violently effervescent
Bk4—69 to 80 inches; light yellowish brown, moderately alkaline fine sandy loam; about 2 percent threads and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.5 inches (Moderate)

Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: High Lime PE 25-36
Ecological site number: R077CY026TX
Typical vegetation: This is a mid and tallgrass site with a lesser shortgrass complement and a few woody plants. Forbs also occur but are not abundant. Grasses that are tolerant of the limey conditions dominate the site. Sideoats grama, blue grama, vine mesquite, western wheatgrass, and alkali sacaton are the more common species. Fourwing saltbush will often be present and a few cholla plants may occur on parts of the site.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Drake soils are used primarily as rangeland and habitat for wildlife. These soils are not used extensively as cropland or improved pasture.
Cropland management: This soil is poorly suited to cropland. The moderate available water capacity, droughtiness, medium runoff, carbonate content, and low natural fertility of the soil are major limitations. The hazard of wind erosion is severe. The most common crops grown are wheat, grain sorghum, and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants yield moderate amounts of forage. The medium runoff, moderate available water capacity, carbonate content, and low natural fertility of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to urban uses. The carbonate content, moderate available water capacity, moderate runoff, and low natural fertility of the soil limits plant growth necessary for healthy lawns and landscaping. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is moderately suited to most recreational uses. They are somewhat limited for use as camping areas, playgrounds, picnic areas, or paths and trails. The slope and dustiness are minor limitations. Applications of water or special surfacing material may be needed during dry periods to prevent excessive dustiness in areas that are subject to heavy foot traffic.

Wildlife habitat: Wind erosion is a potential hazard in the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

EcA—Estacado clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on nearly level plains and occur mainly around or adjacent to playa basins.

Map Unit Composition

Estacado and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Estacado soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Estacado are small areas of Olton, Pantex, and Pullman soils that occur on similar landscape positions. Also included are small areas of Estacado soils that have a surface layer of loam or have slopes of 1 to 3 percent.

The contrasting soils are small areas of Kimberson, Pep, Portales, and Plemons soils. Pep soils occur on similar landscape positions. The Kimberson, Portales, and Plemons soils occur on slightly lower landscape positions.

Soil Description

Estacado

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 6 inches; dark grayish brown, moderately alkaline clay loam; strongly effervescent
Bt1—6 to 19 inches; brown, moderately alkaline clay loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bt2—19 to 38 inches; brown, moderately alkaline clay loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Btk1—38 to 50 inches; pink, moderately alkaline clay loam; about 40 percent films and masses of calcium carbonate; violently effervescent
Btk2—50 to 80 inches; pinkish white, moderately alkaline clay loam; about 35 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton (fig. 13). Other crops include soybeans and forage sorghum. The hazard of wind erosion is severe. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Figure 13.—Harvesting wheat in an area of Estacado clay loam, 0 to 1 percent slopes.

Urban development: This soil is well suited to most urban uses. They are very limited as a site for construction of roads and streets or use as roadfill material. The low soil strength is a major limitation. Stabilizing, strengthening, or replacing the base material can overcome these restrictions.
Recreational development: This soil is well suited to recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

FrB—Friona loam, 1 to 3 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on very gently sloping plains and occur along Tierra Blanca creek in the southwestern part of the county.

Map Unit Composition

Friona and similar soils: 80 percent
Contrasting soils: 20 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Friona soil and similar soils make up 80 percent of the map unit, and contrasting soils make up 20 percent.

The soils similar to Friona are the Kimberson soils that occur on the same landscape position. Also included in the map unit are small areas of Friona soils with slopes less than 1 percent.

The contrasting soils are small areas of Berda, Olton, Pep, Plemons, Potter, and Veal soils. Olton and Pep soils occur on similar landscape positions. The Berda, Plemons, Potter, and Veal soils occur on lower landscape positions.

Soil Description

Friona

Landscape: Plateau
Landform: Plain
Parent material: Loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 8 inches; brown, slightly alkaline loam
Bt1—8 to 15 inches; brown, moderately alkaline sandy clay loam
Bt2—15 to 26 inches; yellowish red, moderately alkaline sandy clay loam; slightly effervescent
Btk—26 to 31 inches; yellowish red, moderately alkaline sandy clay loam; about 5 percent films, threads, concretions, and masses of calcium carbonate; strongly effervescent
Bkm—31 to 35 inches; pinkish white petrocalcic, laminar in the upper part
B'tk—35 to 80 inches; pinkish white, moderately alkaline sandy clay loam; about 50 percent masses and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: Petrocalcic, 20 to 35 inches
Slowest permeability class in the soil profile: Moderate above the petrocalcic
Permeability of restrictive feature: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 4.7 inches (Low)
Natural drainage class: Well drained
Runoff: High
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 3e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used primarily as rangeland and habitat for wildlife. They are not used extensively as cropland or improved pasture.

Cropland management: This soil is moderately suited to cropland. The depth to a cemented pan, low available water capacity, and high runoff are limitations. The hazard of wind erosion is severe. The most common crops grown are wheat and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The depth to a cemented pan, low available water capacity, and high runoff are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression and invasion of woody species, and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is poorly suited to most urban uses (fig. 14). They are very limited as a site for septic tank absorption fields, sewage lagoons, area sanitary landfill, local roads and streets, and use as daily cover for landfills. The depth to a cemented pan and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. The depth to a cemented pan may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area.

Figure 14.—The cemented pan in the Friona loam, 1 to 3 percent slopes, negatively affects the water holding capacity of this soil for crop growth. The cemented layer is a major limitation for septic tank absorption fields.

Recreational development: This soil is moderately suited to most recreational uses. The depth to a cemented pan and low available water capacity are somewhat limiting for use as golf course fairways, campgrounds, picnic areas, and playgrounds.
Wildlife habitat: The slow percolation is a major limitation that restricts plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

GQE—Glenrio-Quay association, 5 to 15 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.
Major land resource area: 70B
Geomorphic setting: These soils occur along the upper Pecos and Canadian valleys and plains in the northwestern part of the county. The Glenrio soils are on moderately sloping to moderately steep hillslopes, interfluves, and low ridges. Quay soils are on moderately sloping hillslopes and alluvial fans.

Map Unit Composition

Glenrio and similar soils: 45 percent
Quay and similar soils: 40 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Glenrio soil and similar soils make up 46 percent of the map unit, the Quay soil and similar soils make up 43 percent of the map unit, and the contrasting soils make up 11 percent.

The soils similar to Glenrio are Lacoca soils that occur on similar landscape positions. The soils similar to Quay are Tucumcari soils that occur on slightly lower landscape positions.

The contrasting soils are small areas of Berwolf, Ima, Mobeetie, Potter, and Veal soils. Mobeetie, Potter, and Veal soils are on slightly higher landscape positions. The Berwolf and Ima soils are on slightly lower landscape positions. Also included in mapping are small areas of rock outcrop, U-shaped gullies and other severely eroded areas.

Soil Description

Glenrio

Landscape: Breaks
Landform: Shoulder on divide; summit on ridge; backslope on hillslope
Parent material: Clayey slope alluvium over residuum weathered from shale and siltstone of Triassic age.

Typical Profile

A—0 to 4 inches; reddish brown, moderately alkaline clay; slightly effervescent
Bw—4 to 14 inches; reddish brown, moderately alkaline clay; strongly effervescent
Cr—14 to 60 inches; red shale bedrock; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 15 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 4 percent coarse very angular gravel, 0 to 5 percent coarse subrounded gravel
Depth to restrictive feature: Bedrock (paralithic), 10 to 20 inches
Slowest permeability class in the soil profile: Slow above the bedrock
Permeability of restrictive feature: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Red Shale PE 25-31
Ecological site number: R070EY664TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses. Vegetation consists of sparse stands of blue grama, little bluestem, sideoats grama, buffalograss, galleta, and perennial threeawn. A moderate amount of forbs and shrubs are also present such as broom snakeweed, threeawn, catclaw acacia, dalea, prickly pear, saltbush, and mesquite.

Quay

Landscape: Breaks
Landform: Hillslope; footslope on alluvial fan
Parent material: Calcareous, loamy alluvium weathered from sandstones and siltstone of Triassic and Permian age.

Typical Profile

A1—0 to 3 inches; reddish brown, moderately alkaline loam; slightly effervescent
A2—3 to 9 inches; light reddish brown, moderately alkaline loam; slightly effervescent
Bw—9 to 19 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bk—19 to 26 inches; reddish brown, moderately alkaline clay loam; about 30 percent masses and nodules of calcium carbonate; violently effervescent
BCk1—26 to 36 inches; light brown, moderately alkaline clay loam; about 25 percent masses and nodules of calcium carbonate; violently effervescent
BCk2—36 to 80 inches; pinkish gray, moderately alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate

Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.8 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Loamy PE 25-31
Ecological site number: R070XB052NM
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. Galleta and buffalograss are next in importance. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the "Table" section.

Use and Management

Major land uses: These soils are used as rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The shallow depth to bedrock, droughtiness, and very low available water capacity of Glenrio soils, and the slope and runoff of both soils are major limitations. The hazard of erosion is severe.
Rangeland management: In the Glenrio soils native plants yield low amounts of forage. The slope, shallow depth to bedrock, very low available water capacity, and very high runoff are major limitations. In the Quay soils native plants are dominantly short and midgrasses, which produce moderate amounts of forage. The slope, moderate runoff, and moderate available water capacity are limitations. The hazard of erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: Glenrio soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities or building site development. The slope, depth to soft bedrock, droughtiness, high clay content and shrink-swell potential, and low soil strength are major limitations. Overcoming many of these limitations is difficult and costly. Quay soils are moderately suited to most urban uses. They are very limited as a site for local roads and streets because of low soil strength and somewhat limited as a site for sewage lagoons because of slope. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of both these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: Glenrio soils are poorly suited to most recreational uses. They are very limited as a site for camp areas, picnic areas, playgrounds, and golf course fairways. The slope, depth to bedrock, very low available water capacity, high clay content, and droughtiness are major limitations. Quay soils are moderately suited to

most recreational uses. They are very limited as a site for playgrounds because of slope.

Wildlife habitat: The shallow rooting depth, clay content, slow percolation of Glenrio soils, and the arid conditions of both soils are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

IMC—Ima and Lacoca loamy fine sands, 1 to 8 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.

Major land resource area: 70B

Geomorphic setting: These soils occur along the upper Pecos and Canadian valleys and plains in the northeastern corner of the county. Ima soils are on very gently to gently sloping alluvial fans, stream terraces, and hillslopes. Lacoca soils are on very gently to moderately sloping ridge summits and side slopes of erosion remnants.

Map Unit Composition

Ima and similar soils: 50 percent

Lacoca and similar soils: 40 percent

Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Ima soil and similar soils make up 50 percent of the map unit, the Lacoca soil and similar soils make up 40 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Ima are the Berwolf and Mobeetie soils that occur on similar landscape positions. The soils similar to Lacoca are the Glenrio soils that occur on similar landscape positions or Lacoca soils that have indurated sandstone that ranges from 20 to 40 inches deep.

The contrasting soils are the Minneosa, Redona, and Quay soils. Minneosa soils are on lower landscape positions. The Redona and Quay soils are on slightly lower landscape positions. Also included in mapping are small areas of sandstone outcrop.

Soil Description

Ima

Landscape: Breaks

Landform: Toeslope on alluvial fan; backslope on hillslope; riser footslope on stream terrace

Parent material: Alluvium and eolian sediments weathered from sandstones and shales of Jurassic, Triassic, and Permian age.

Typical Profile

A1—0 to 5 inches; reddish brown, slightly alkaline loamy fine sand

A2—5 to 10 inches; reddish brown, moderately alkaline fine sandy loam

Bw—10 to 32 inches; light reddish brown, moderately alkaline fine sandy loam; about 1 percent masses of calcium carbonate; strongly effervescent

Bk—32 to 40 inches; light reddish brown, moderately alkaline fine sandy loam; about 8 percent masses of calcium carbonate; violently effervescent
C—40 to 80 inches; reddish yellow, moderately alkaline very fine sandy loam; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: 1 to 5 percent fine subangular gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 7.5 inches (Moderate)
Natural drainage class: Well drained
Runoff: Very low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6c
Land capability irrigated: None specified
Ecological site name: Sandy Plains
Ecological site number: R070XB054NM
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a smaller tallgrass complement. Midgrasses, tend to dominate over most of the site with sideoats grama being the most prevalent midgrass species. Blue grama is the dominant shortgrass species and little bluestem the dominant tallgrass species. Small areas may occur within the site where blue grama is more prevalent. Woody plants are few but include yucca, catclaw acacia, and sand sage.

Lacoca

Landscape: Breaks
Landform: Shoulder on erosion remnant; summit on ridge
Parent material: Calcaerous, loamy colluvium and residuum weathered from calcareous sandstone of Triassic age.

Typical Profile

A—0 to 8 inches; light brown, moderately alkaline loamy fine sand; strongly effervescent
R—8 to 80 inches; sandstone bedrock

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 8 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent fine subangular gravel
Depth to restrictive feature: Bedrock (lithic), 4 to 14 inches

Slowest permeability class in the soil profile: Moderately rapid above the bedrock
Permeability of restrictive feature: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 0.7 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Shale Sandstone PE 25-31
Ecological site number: R070XA005NM
Typical vegetation: The potential natural plant community is a mixture of midgrasses with a few tallgrass species present. A moderate amount of forbs and shrubs are also present. Vegetation is sparse and consists of sideoats grama, little bluestem, hairy grama, and perennial threeawn. Some woody shrubs such as catclaw acacia, dalea, juniper, and hackberry occur along with numerous forbs.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used as rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The depth to bedrock, very high runoff, and very low available water capacity of Lacoca soils is a major limitation. The slope, droughtiness, and low natural fertility are limitations for both soils. The hazard of erosion is severe.
Rangeland management: In the Ima soils native plants yield moderate amounts of forage. The moderate available water capacity and low natural fertility of the soil are limitations. In the Lacoca soils native plants yield low amounts of forage. The depth to bedrock, very low available water capacity, and a very high runoff are major limitations. The hazard of erosion is severe for both soils. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: Ima soils are moderately suited to most urban uses. They are very limited as a site for sewage lagoons. The hazard of seepage, which can contaminate aquifers, wells, and streams, is a major limitation. Lining the floor and sides of the sewage lagoon with relatively impervious material can minimize the potential for contamination. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. The Lacoca soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities or building site development. The depth to bedrock, droughtiness, and sand content are major limitations. Overcoming many of these limitations is difficult and costly.
Recreational development: Ima soils are well suited to most recreational uses. The sand content is a minor limitation. Glenrio soils are poorly suited to most recreational uses. They are very limited as a site for camp areas, picnic areas, playgrounds, and golf

course fairways. The very low available water capacity, depth to bedrock, and droughtiness are major limitations.

Wildlife habitat: The shallow rooting depth and very low available water capacity of Lacoca soils and the arid conditions of both soils are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

KmB—Kimberson gravelly loam, 0 to 3 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on nearly level to very gently sloping plains and occur around Garcia lake in the southwest part of the county and along Tierra Blanca creek.

Map Unit Composition

Kimberson and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Kimberson soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Kimberson are small areas of Friona and Potter soils. Also included are Kimberson soils that have small areas of exposed indurated caliche.

The contrasting soils are small areas of Estacado, Olton, and Pep soils that occur on similar landscape positions.

Soil Description

Kimberson

Landscape: Plateau
Landform: Plain; low hill
Parent material: Calcareous, loamy alluvium from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 5 inches; dark grayish brown, moderately alkaline gravelly loam; 15 percent gravel and cobble size petrocalcic fragments; strongly effervescent

A2—5 to 11 inches; dark grayish brown, moderately alkaline very gravelly loam; 40 percent gravel and cobble size petrocalcic fragments; violently effervescent

Bkm—11 to 28 inches; white petrocalcic, laminar in the upper part

Bk—28 to 64 inches; white and light gray, moderately alkaline extremely gravelly fine sandy loam; 85 percent gravel and cobble size petrocalcic fragments; violently effervescent

B'km—64 to 80 inches; white petrocalcic, laminar in the upper part

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 20 percent very angular channers
Depth to restrictive feature: Petrocalcic, 4 to 20 inches
Slowest permeability class in the soil profile: Moderate above the petrocalcic
Permeability of restrictive feature: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 1.3 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077CY037TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used mainly as rangeland and wildlife habitat.
Cropland management: This soil is poorly suited to cropland. The shallow rooting depth, very low available water capacity, and droughtiness are major limitations. The hazard of wind erosion is severe. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants yield low amounts of forage. The depth to a cemented pan, very low available water capacity, and very high runoff are major limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is poorly suited to urban uses. They are very limited as a site for sanitary facilities and building site development. The depth to a cemented pan, carbonate content, and droughtiness is a major limitation. Overcoming many of these limitations is difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.
Recreational development: This soil is poorly suited to most recreational uses. They are very limited as a site for golf course fairways, playgrounds, camping areas, and picnic

areas. The depth to a cemented pan, very low available water capacity, droughtiness, gravel content, and carbonate content of the soil are major limitations.

Wildlife habitat: The low available water capacity and slow percolation are major limitations that restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

LcA—Lazbuddie clay, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These nearly level soils are on playa steps within large playa basins that occur in scattered areas throughout the county.

Map Unit Composition

Lazbuddie and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Lazbuddie soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Lazbuddie are the Lofton soils that occur on similar landscape positions. Also included are Lazbuddie soils with a mollic epipedon, or a calcic less than 40 inches deep.

The contrasting soils are small areas of Drake, McLean, Pep, Portales, and Randall soils. Drake and Pep soils are on higher landscape positions. The Portales soil occurs on slightly higher landscape positions. The McLean and Randall soils are on slightly lower landscape positions.

Soil Description

Lazbuddie

Landscape: Plateau
Landform: Tread on playa step
Parent material: Calcareous, clayey lacustrine sediments of Quaternary age.

Typical Profile

Ap—0 to 4 inches; grayish brown, moderately alkaline clay; strongly effervescent
Bw—4 to 12 inches; light grayish brown, moderately alkaline clay; strongly effervescent
Bss1—12 to 35 inches; light brownish gray, moderately alkaline clay; strongly effervescent
Bss2—35 to 45 inches; light gray, moderately alkaline clay; violently effervescent
Bkss1—45 to 69 inches; grayish brown, moderately alkaline clay; about 12 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bkss2—69 to 80 inches; light gray, moderately alkaline clay; about 5 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.9 inches (Moderate)
Natural drainage class: Moderately well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Occasional
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3s
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the "Table" section.

Use and Management

Major land uses: Lazbuddie soils are used primarily as rangeland or pastureland. A few small areas are used as cropland.
Cropland management: This soil is well suited to cropland. The clayey texture of the soil, which can restrict root development and occasional, very brief ponding are minor limitations. The most common crops grown are wheat and grain sorghum. Other crops include cotton and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. High yields of forage can be obtained during favorable years. The clayey texture of the soil, which can restrict root development, is a minor limitation. Other concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is poorly suited to urban uses. They are very limited a site for sanitary facilities and building site development. The high clay content, restricted permeability, high shrink-swell potential, low strength, and very brief ponding are

major limitations. Overcoming many of these limitations is difficult and costly. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Recreational development: This soil is poorly suited to recreational uses. The high clay content of the soil and very brief ponding are major limitations.

Wildlife habitat: The clayey surface texture is a limitation which affects plant growth necessary for good habitat.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

LoA—Lofton clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These nearly level soils are on shallow drainageways, small depressions, or playa steps within large playa basins and occur throughout the county.

Map Unit Composition

Lofton and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Lofton soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Lofton are the Lazbuddie soils that occur on similar landscape positions.

The contrasting soils are small areas of Estacado, McLean, Pep, Portales, and Randall soils. Estacado, Pep, and Portales soils are on higher landscape positions. The McLean and Randall soils are on slightly lower landscape positions.

Soil Description

Lofton

Landscape: Plateaus or tablelands
Landform: Playa step; depression
Parent material: Clayey sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

A—0 to 9 inches; dark gray, slightly alkaline clay loam
Bt1—9 to 24 inches; dark grayish brown, slightly alkaline clay
Bt2—24 to 38 inches; grayish brown, moderately alkaline clay
Btk—38 to 52 inches; grayish brown, moderately alkaline clay; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bk—52 to 80 inches; grayish brown, moderately alkaline silty clay; about 25 percent threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Moderately well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Occasional
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is moderately suited to cropland. The clayey texture of the soil, which can restrict root development and occasional ponding, are limitations. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include alfalfa, forage sorghum, and soybeans. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is poorly suited to most urban uses. They are very limited for use as sanitary facilities and building site development. The high clay content,

restricted permeability, high shrink-swell potential, low strength, and occasional ponding are major limitations. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is poorly suited to recreational uses. They are very limited because of occasional ponding. The season, frequency, and duration of ponding should be considered in planning recreational areas.

Wildlife habitat: The slow percolation of the soil is a major limitation for the production of grain and seed crops and domestic grasses and legumes used for food and cover. The moderately clayey surface texture is a minor limitation, which affects plant growth necessary for good habitat.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

M-W—Miscellaneous water

This unit consists of small constructed ponds or pits that are used for industrial, sanitary, or mining applications. They contains water most of the year and are typically 5 to 20 acres in size.

McA—McLean clay, 0 to 1 percent slopes, occasionally ponded

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These nearly level soils are on the floor of playa basins and occur in scattered areas throughout the county.

Map Unit Composition

McLean and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the McLean soil and similar soils make up 95 percent of the map unit, and contrasting soils make up 5 percent.

The soils similar to McLean are the Lazbuddie and Randall soils that occur on similar landscape positions. Also included are small areas of McLean soils that have a loamy overburden of soil material that has eroded from surrounding soils.

The contrasting soils are small areas of Estacado, Lofton, Pep, and Portales soils. Estacado, Pep, and Portales soils are on higher landscape positions. The Lofton soils are on similar but slightly higher landscape positions.

Soil Description

McLean

Landscape: Plateaus or tablelands
Landform: Playa floor
Parent material: Clayey lacustrine sediments of Quaternary age.

A—0 to 7 inches; dark gray, moderately alkaline clay

Bss1—7 to 21 inches; dark gray, moderately alkaline clay; about 1 percent nodules of calcium carbonate
Bss2—21 to 37 inches; dark gray, moderately alkaline clay; about 1 percent nodules of calcium carbonate
Bss3—37 to 42 inches; dark grayish brown, moderately alkaline clay; about 1 percent nodules of calcium carbonate
Bss4—42 to 59 inches; dark grayish brown, moderately alkaline clay; about 1 percent threads and nodules of calcium carbonate; slightly effervescent
Bkss—59 to 80 inches; grayish brown, moderately alkaline clay; about 4 percent masses and nodules of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Somewhat poorly drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Occasional
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4w
Land capability irrigated: 4w
Ecological site name: Playa PE 25-36
Ecological site number: R077CY027TX
Typical vegetation: The potential natural plant community of a playa is highly variable and dependent on the hydrology of the playa basin being considered. The dominance of hydrophytic plants or upland plants depends on the degree, frequency, and time of inundation. Vegetation varies according to the amount of water available during the growing season. On average years, the dominant plant community for this site is a mixture of upland grasses and forbs with highly variable amounts of hydrophytic plants present. Very few shrubs or woody plants occur on this site. The most common plants are western wheatgrass, vine mesquite, barnyard grass, buffalograss, bur ragweed, saltmarsh aster, sedges, coreopsis, lambs quarters, cocklebur, curly dock, Pennsylvania smartweed, and common spikerush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: McLean soils are used primarily as rangeland and habitat for wildlife. These soils are not used extensively as cropland.
Cropland management: This soil is moderately suited to cropland. The clayey texture of the soil, which can restrict root development and occasional ponding, are limitations. The most common crops grown are wheat and grain sorghum. Other crops include

cotton and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: High yields of forage can be obtained during favorable years. Occasional ponding and the high clay content of the soil are limitations that can restrict plant growth. Other concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is poorly suited to urban uses. They are very limited a site for sanitary facilities and building site development. Occasional ponding, high clay content, restricted permeability, high shrink-swell potential, and low strength are major limitations. Overcoming many of these limitations is difficult and costly. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Recreational development: This soil is poorly suited to recreational uses. The high clay content of the soil and occasional ponding is very limiting.

Wildlife habitat: The clayey surface texture is a major limitation, which affects plant growth necessary for good habitat. Occasional ponding is a minor limitation. Waterfowl, such as ducks and geese, make limited use of this habitat for food and cover.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

MNA—Minneosa soils, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.

Major land resource area: 70B

Geomorphic setting: These soils are on nearly level to very gently sloping flood plains in the northwestern part of the county.

Map Unit Composition

Minneosa and similar soils: 90 percent

Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Minneosa soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Minneosa are the Ima and Mobeetie soils that occur on higher landscape positions.

The contrasting soils are small areas of Lacoca, Quay, and Redona soils that occur on higher landscape positions.

Soil Description

Minneosa

Landscape: Breaks
Landform: Ephemeral stream on draw
Parent material: Sandy alluvial sediments of Holocene age

Typical Profile

A—0 to 10 inches; light brown, moderately alkaline loamy fine sand; finely disseminated calcium carbonate
C1—10 to 44 inches; very pale brown, slightly alkaline loamy fine sand; finely disseminated calcium carbonate
C2—44 to 80 inches; very pale brown, slightly alkaline sand; few very fine calcium carbonate nodules

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 2 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Sodicity, maximum within 40 inches: Not sodic
Available water capacity: About 5.4 inches (Low)
Natural drainage class: Somewhat excessively drained
Runoff: Negligible
Annual flooding: Occasional
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6c
Land capability irrigated: 6c
Ecological site name: Bottomland PE 25-31
Ecological site number: R070XB056NM
Typical vegetation: The potential natural plant community for this site is tall and midgrass site with a few shortgrasses and forbs. The most prevalent grasses are alkali sacaton, giant sacaton, vine mesquite, tobosa, and blue grama. The most dominant shrubs are fourwing saltbush and sand sagebrush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used as rangeland and wildlife habitat.

Cropland management: These soils are poorly suited to cropland. The occasional flooding, droughtiness, low available water capacity, and low natural fertility of the soil are major limitations. Most areas are so narrow that use as cropland is limited. The hazard of wind erosion is severe.
Rangeland management: Native plants yield moderate amounts of forage. The low available water capacity and low natural fertility of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are poorly suited to urban uses. They are very limited as a site for sanitary facilities or building site development. The filtering capacity, seepage, flooding, and sand content are major limitations. Overcoming many of these limitations is difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.
Recreational development: These soils are moderately suited to most recreational uses. They are very limited as a site for camp areas unless protected from the hazard of flooding. The season, duration, and frequency of flooding should be considered in planning playgrounds and other recreational areas.
Wildlife habitat: The low available water capacity and droughtiness are major limitations, which can restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

MoC—Mobeetie fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico
Major land resource area: 77E
Geomorphic setting: These soils are on gently sloping valley sides, valley floors, and alluvial fans that occur along the southern high plains breaks or on similar hillslope positions along drainageways of Tierra Blanco Creek in the southeast part of the county.

Map Unit Composition

Mobeetie and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Mobeetie soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Mobeetie are the Ima and Veal soils that occur on similar landscape positions. Included in mapping are Mobeetie soils with slopes of 5 to 8 percent.

The contrasting soils are the Berda, Glenrio, Lacoca, Potter, and Quay soils. Berda and Potter soils are on similar landscape positions. The Glenrio, Lacoca, and Quay soils are on slightly lower landscape positions.

Soil Description

Mobeetie

Landscape: Breaks
Landform: Toeslope on valley side; toeslope on valley floor; toeslope on alluvial fan
Parent material: Calcareous, sandy colluvium and slope alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 8 inches; grayish brown, moderately alkaline fine sandy loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Bw—8 to 25 inches; light brown, moderately alkaline fine sandy loam; about 2 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bk—25 to 41 inches; pink, moderately alkaline fine sandy loam; about 4 percent films, threads, and nodules of calcium carbonate; violently effervescent
BC—41 to 80 inches; pink, moderately alkaline fine sandy loam; about 3 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Very low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 4e
Ecological site name: Mixedland Slopes PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used mainly as rangeland and wildlife habitat.

Cropland management: These soils are poorly suited to cropland. The moderate available water capacity, low natural fertility, and high carbonate content of the soil are limitations. The hazard of wind erosion is severe.

Rangeland management: Native plants yield moderate amounts of forage (fig. 15). Droughtiness and moderate available water capacity is a limitation. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: These soils are well suited to most urban uses. They are very limited as a site for sewage lagoons. Seepage is a major limitation. Lining the floor and sides of sewage lagoons with relatively impervious material can minimize the potential for contamination of aquifers, streams, and wells.

Recreational development: These soils are well suited to most recreational uses. The slope is a minor limitation for playgrounds.

Wildlife habitat: Droughtiness and moderately arid conditions, which can limit plant growth necessary for good habitat, are limitations. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

Figure 15.—Areas of Mobeetie fine sandy loam, 5 to 12 percent slopes are used for livestock grazing and for wildlife habitat.

MoD—Mobeetie fine sandy loam, 5 to 12 percent slopes

Map Unit Setting

General location: Southern High Plains; Breaks of western Texas and eastern New Mexico
Major land resource area: 77E
Geomorphic setting: These soils are on moderately to strongly sloping valley side slopes and hillslopes that occur along the southern high plains breaks in the northwestern part of the county.

Map Unit Composition

Mobeetie and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Mobeetie soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Mobeetie are the Veal soils that occur on similar landscape positions.

The contrasting soils are the Berda, Glenrio, Lacoca, Potter, and Quay soils. Berda and Potter soils are on similar landscape positions. The Glenrio, Lacoca, and Quay soils are on slightly lower landscape positions.

Soil Description

Mobeetie

Landscape: Breaks
Landform: Backslope on valley side; backslope on hillslope
Parent material: Calcareous, sandy colluvium and slope alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 7 inches; grayish brown, moderately alkaline fine sandy loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Bw—7 to 23 inches; light brown, moderately alkaline fine sandy loam; about 2 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bk—23 to 39 inches; pink, moderately alkaline fine sandy loam; about 4 percent films, threads, and nodules of calcium carbonate; violently effervescent
BC—39 to 80 inches; pink, moderately alkaline fine sandy loam; about 3 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 12 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.4 inches (Moderate)
Natural drainage class: Well drained

Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Mixedland Slopes PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used mainly as rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The slope, moderate available water capacity, low natural fertility, and high carbonate content of the soil are limitations. The hazard of wind erosion is severe.
Rangeland management: Native plants yield moderate amounts of forage. The slope, droughtiness, and moderate available water capacity is a limitation. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are moderately suited to most urban uses. They are very limited as a site for small commercial buildings and sewage lagoons. The slope and seepage are major limitations. Lining the floor and sides of sewage lagoons with relatively impervious material can minimize the potential for contamination of aquifers, streams, and wells.
Recreational development: These soils are moderately suited to most recreational uses. The slope is a major limitation for use as playgrounds.
Wildlife habitat: Droughtiness and moderately arid conditions, which can limit plant growth necessary for good habitat, are limitations. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

MVE—Mobeetie-Veal-Potter association, 5 to 20 percent slopes

Map Unit Setting

General location: Southern High Plains; Breaks of western Texas and eastern New Mexico
Major land resource area: 77E

Geomorphic setting: These soils occur mainly along the High Plains Breaks and on drainage areas of Tierra Blanco Creek in the southwest corner of the county. The Mobeetie soils are on moderately sloping to moderately steep scarp slopes and valley side slopes. Veal soils are on moderately sloping to moderately steep scarp slopes and knolls. Potter soils are on moderately sloping to moderately steep hillslopes and scarp slopes.

Map Unit Composition

Mobeetie and similar soils: 50 percent
Veal and similar soils: 25 percent
Potter and similar soils: 15 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Mobeetie soil and similar soils make up 49 percent of the map unit, the Veal soil and similar soils make up 25 percent of the map unit, and the Potter soil and similar soils make up 16 percent of the map unit. The contrasting soils make up 10 percent.

The soils similar to Mobeetie are the Ima soils. The soils similar to Veal are the Plemons soils. The soils similar to Potter are the Kimberson soils.

The contrasting soils are small areas of Berda, Glenrio, Lacoca, Minneosa, and Quay soils. Berda soils are on similar landscape positions. The Glenrio, Lacoca, Minneosa, and Quay soils are lower landscape positions. Also included in mapping are small areas of rock outcrop, borrow pits less than 3 acres in size, narrow stream channels, and U-shaped gullies.

Soil Description

Mobeetie

Landscape: Breaks
Landform: Backslope on valley side; Backslope on hillslope; footslope on scarp slope
Parent material: Calcareous, sandy colluvium and slope alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 8 inches; grayish brown, moderately alkaline fine sandy loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Bw—8 to 25 inches; light brown, moderately alkaline fine sandy loam; about 2 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bk—25 to 41 inches; pink, moderately alkaline fine sandy loam; about 4 percent films, threads, and nodules of calcium carbonate; violently effervescent
BC—41 to 80 inches; pink, moderately alkaline fine sandy loam; about 3 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 20 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches

Available water capacity: About 6.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Mixedland Slopes PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Veal

Landscape: Breaks
Landform: Summit on knoll; Backslope on hillslope; Footslope on scarp slope
Parent material: Calcareous, loamy colluvium over slope alluvium derived from the Ogallala Formation of Miocene and Pliocene age

Typical Profile

A—0 to 8 inches; brown, moderately alkaline fine sandy loam; about 1 percent nodules of calcium carbonate; violently effervescent
Bk1—8 to 17 inches; pale brown, moderately alkaline sandy clay loam; about 20 percent nodules of calcium carbonate; violently effervescent
Bk2—17 to 36 inches; pink, moderately alkaline sandy clay loam; about 50 percent masses and nodules of calcium carbonate; violently effervescent
Bk3—36 to 80 inches; pink, moderately alkaline sandy clay loam; about 50 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 20 percent
Surface features: None specified
Percent of area covered by surface fragments: 0 to 5 percent coarse subangular gravel, 0 to 4 percent coarse very angular gravel, 0 to 4 percent coarse subrounded gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.8 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: None specified
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Potter

Landscape: Breaks
Landform: Shoulder on hillslope; shoulder on scarp
Parent material: Calcareous, loamy alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam; about 22 percent moderately to strongly cemented calcium carbonate fragments; strongly effervescent
A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments, 1 to 3 inches across; violently effervescent
BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent
BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 5 to 20 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent subangular cobbles
Depth to restrictive feature: Cemented horizon, None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: HIgh
Annual flooding: None
Annual ponding: None

Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The slope, very low to moderate available water capacity, moderate to very high runoff, high carbonate content, and high gravel content of the soils are major limitations.
Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and medium to very high runoff is a major limitation for Veal and Potter soils. Droughtiness and available water capacity is a limitation for all of these soils. The hazard of erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are poorly suited to most urban uses. The slope, carbonate content, gravel content, seepage, and low to moderate available water capacity are major limitations. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.
Recreational development: These soils are poorly suited to most recreational uses. They are very limited as a site for camp areas, picnic areas, playgrounds, and golf course fairways. The slope, droughtiness, gravel content, and high carbonate content of the soil are major limitations.
Wildlife habitat: Wind and water erosion are a potential hazard for the production of grain and seed crops or of domestic grasses and legumes used for food and cover. The arid conditions, which can limit plant growth necessary for good habitat, are a major limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

OcA—Olton clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C

Geomorphic setting: These soils are on nearly level plains and occur mainly in the southwestern part of the county.

Map Unit Composition

Olton and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Olton soil and similar soils make up 94 percent of the map unit, and contrasting soils make up 6 percent.

The soils similar to Olton are the Estacado, Pantex, and Pullman soils that occur on similar landscape positions. Also included are small areas of Olton soils that have slopes of 1 to 3 percent.

The contrasting soils are small areas of Pep and Portales soils that occur on similar or slightly lower landscape positions.

Soil Description

Olton

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 8 inches; brown, neutral clay loam
Bt1—8 to 15 inches; brown, slightly alkaline clay loam
Bt2—15 to 31 inches; reddish brown, moderately alkaline clay loam; slightly effervescent
Btk1—31 to 48 inches; reddish brown, moderately alkaline clay loam; about 5 percent films and threads of calcium carbonate; violently effervescent
Btk2—48 to 75 inches; pink, moderately alkaline clay loam; about 35 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—75 to 80 inches; red, moderately alkaline clay loam; about 5 percent films of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the "Table" section.

Use and Management

Major land uses: These soils are used extensively for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include alfalfa, forage sorghum, and soybeans (fig. 16). The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Figure 16.—Nearly level areas of Olton clay loam are well suited to growing irrigated soybeans and other crops.

Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for septic tank absorption fields and for local roads and streets. The low soil strength and restricted permeability are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. The moderately slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. The shrink-swell potential is somewhat limiting for dwellings or small commercial buildings. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils.
Recreational development: This soil is well suited to recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

OcB—Olton clay loam, 1 to 3 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on very gently sloping plains and occur mainly in the southwestern part of the county or along Tierra Blanca Creek in the southern part of the county.

Map Unit Composition

Olton and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Olton soil and similar soils make up 94 percent of the map unit, and contrasting soils make up 6 percent.

The soils similar to Olton are the Estacado and Pullman soils that occur on similar landscape positions. Also included are small areas of Olton soils that have slopes of 3 to 5 percent.

The contrasting soils are small areas of Pep and Portales soils that occur on similar or slightly lower landscape positions.

Soil Description

Olton

Landscape: Plateaus or tablelands
Landform: Plain; playa slope
Parent material: Clayey eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 7 inches; brown, neutral clay loam
Bt1—7 to 13 inches; brown, slightly alkaline clay loam
Bt2—13 to 29 inches; reddish brown, moderately alkaline clay loam; slightly effervescent
Btk1—29 to 46 inches; reddish brown, moderately alkaline clay loam; about 5 percent films and threads of calcium carbonate; violently effervescent
Btk2—46 to 73 inches; pink, moderately alkaline clay loam; about 35 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—73 to 80 inches; red, moderately alkaline clay loam; about 5 percent films of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.4 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 3e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used extensively for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include alfalfa, forage sorghum, and soybeans. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils.

Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for septic tank absorption fields and for local roads and streets. The low soil strength and restricted permeability are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. The moderately slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. The shrink-swell potential is somewhat limiting for dwellings or small commercial buildings. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils.

Recreational development: This soil is well suited to recreational uses.

Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PcA—Pep clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on nearly level plains and occur mainly in the western and central part of the county.

Map Unit Composition

Pep and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pep soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Pep are the Estacado and Portales soils that occur on similar landscape positions. Also included are slopes of 1 to 3 percent.

The contrasting soils are small areas of Friona, Kimberson, Olton, Pantex, and Pullman soils that occur on similar landscape positions.

Soil Description

Pep

Landscape: Plateaus or tablelands
Landform: Plain

Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 10 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—10 to 16 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—16 to 32 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—32 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.
Cropland management: This soil is moderately suited to cropland. The moderate available water capacity and high carbonate content of the soil are limitations. The hazard of wind erosion is severe. The most common crops grown are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil

erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is moderately suited to most recreational uses. They are very limited as a site for golf course fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation.

Wildlife habitat: Wind erosion is a potential hazard for grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PcB—Pep clay loam, 1 to 3 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on very gently sloping plains and occur mainly on slopes around playas and along Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Pep and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pep soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Pep are the Estacado and Portales soils that occur on similar landscape positions. Also included are slopes of 3 to 5 percent.

The contrasting soils are small areas of Friona, Kimberson, Olton, Plemons, and Pullman soils that occur on similar landscape positions.

Soil Description

Pep

Landscape: Plateaus or tablelands
Landform: Playa slope; plain
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 9 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—9 to 15 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—15 to 31 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—31 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 3e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrasses and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.

Cropland management: This soil is moderately suited to cropland. The moderate available water capacity and high carbonate content of the soil are limitations. The hazard of wind erosion is severe. The most common crops grown are wheat, grain sorghum, cotton, and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion (fig. 17). Fertilizer applications, reduces tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is moderately suited to most recreational uses. They are very limited as a site for golf course fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation.

Figure 17.—The main concerns in managing this cropland field of Pep clay loam, 1 to 3 percent slopes, are conserving soil moisture and controlling soil erosion.

Wildlife habitat: Wind erosion is a potential hazard for grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PcC—Pep clay loam, 3 to 5 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on gently sloping plains and occur mainly on slopes around playas and along Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Pep and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pep soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Pep are small areas of Estacado soils. Also included are small areas of Pep soils that have slopes of 5 to 8 percent.

The contrasting soils are small areas of Berda, Drake, Plemons, Potter, and Veal soils. Berda, Plemons, Potter, and Veal soils are on slightly lower landscape positions. The Drake soils are on higher landscape positions.

Soil Description

Pep

Landscape: Plateau
Landform: Plain; Backslope on draw; playa slope
Parent material: Calcareous, loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 8 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bw1—8 to 14 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; strongly effervescent
Bw2—14 to 30 inches; yellowish red, moderately alkaline clay loam; about 2 percent films and threads of calcium carbonate; violently effervescent
Bk—30 to 80 inches; reddish yellow, moderately alkaline clay loam; about 50 percent films, threads, masses, and concretions of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None

Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6e
Land capability irrigated: 4e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used primarily as rangeland and habitat for wildlife. They are not used extensively as cropland or improved pasture.
Cropland management: This soil is moderately suited to cropland. The moderate available water capacity and high carbonate content of the soil are limitations. The hazard of wind erosion is severe. The most common crops grown are wheat and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited for use as daily cover for landfills, lawns and landscaping, roadfill material, or the construction of roads and streets. The high carbonate content, moderate available water capacity, and low soil strength are major limitations. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is moderately suited to most recreational uses. They are very limited as a site for golf course fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation.
Wildlife habitat: Wind erosion is a potential hazard for the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PGE—Potter soils, 3 to 20 percent slopes

Map Unit Setting

General location: Southern High Plains; Breaks of western Texas and eastern New Mexico
Major land resource area: 77E
Geomorphic setting: These soils are on gently sloping to moderately steep crests of draws and scarps and occur mainly along the southern high plains breaks and along drainageways of Tierra Blanco and Palo Duro Creeks.

Map Unit Composition

Potter and similar soils: 80 percent
Contrasting soils: 20 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Potter soil and similar soils make up 80 percent of the map unit, and contrasting soils make up 20 percent.

The soils similar to Potter are the Kimberson soils that occur on slightly higher landscape positions.

The contrasting soils are small areas of Berda, Glenrio, Mobeetie, Plemons, and Veal soils that occur on similar landscape positions.

Soil Description

Potter

Landscape: Breaks
Landform: Shoulder on draw; shoulder on scarp
Parent material: Calcareous, loamy alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam; about 22 percent moderately to strongly cemented calcium carbonate fragments; strongly effervescent
A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments, 1 to 3 inches across; violently effervescent

BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent

BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 20 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent subangular cobbles
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used mainly as rangeland and wildlife habitat.
Cropland management: This soil is not used as cropland. The very low available water capacity, carbonate content, droughtiness, slope, shallow rooting depth, and very high runoff are major limitations.
Rangeland management: Native plants yield low amounts of forage. The high carbonate content of the soil, very low available water capacity, slopes, and very high runoff is a major limitation. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is poorly suited to urban uses. They are very limited for use as sanitary facilities and building site development. The slopes, droughtiness, gravel, and carbonate content is a major limitation. Overcoming many of these limitations is

difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Recreational development: These soils are poorly suited to most recreational uses. They are very limited as a site for golf course fairways and playgrounds. The gravel content, slope, low available water capacity, and carbonate content of the soil are major limitations. Other recreational use is somewhat limited because of the slope and dustiness.

Wildlife habitat: The low available water capacity and arid conditions are major limitations that restrict plant growth necessary for good habitat. The potential for water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PMG—Potter-Mobeetie association, 8 to 45 percent slopes

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico

Major land resource area: 77E

Geomorphic setting: These soils occur mainly along the southern high plains breaks and a small drainage area of Tierra Blanco creek in the southwest corner of the county. The Potter soils are on strongly sloping to steep hillslopes and near vertical scarp slopes. Mobeetie soils are on strongly sloping to steep hillslopes and scarp slopes.

Map Unit Composition

Potter and similar soils: 45 percent

Mobeetie and similar soils: 40 percent

Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Potter soil makes up 44 percent of the map unit, the Mobeetie soil makes up 40 percent of the map unit, and the contrasting soils make up 16 percent.

The soils similar to the Potter are small areas of Kimberson soils. The soils similar to Mobeetie are the Veal soils.

The contrasting soils are Berda, Glenrio, Lacoca, Plemons, and Quay soils. Berda and Plemons soils are on similar landscape positions. The Glenrio and Lacoca soils are on lower landscape positions. Also included in mapping are areas of rock outcrop, borrow pits less than 3 acres in size, and U-shaped gullies.

Soil Description

Potter

Landscape: Breaks

Landform: Shoulder on scarp; shoulder on hillslope (fig. 18 and fig. 19)

Parent material: Calcareous, loamy alluvium derived from the upper part of the Ogallala Formation of Miocene-Pliocene age.

Figure 18.—Potter soils, a major component in the Potter-Mobeetie association, 8 to 45 percent slopes, can occur on steep escarpments. This soil formed in loamy, calcareous sediments derived from the Ogallala Formation.

Figure 19.—An area of exposed Caprock caliche in the Potter soils commonly occurs on steep escarpments in the Potter-Mobeetie association, 8 to 45 percent slopes.

Typical Profile

A1—0 to 2 inches; grayish brown, moderately alkaline gravelly loam; about 22 percent moderately to strongly cemented calcium carbonate fragments; strongly effervescent
A2—2 to 6 inches; brown, moderately alkaline extremely gravelly fine sandy loam; about 63 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
Bk—6 to 15 inches; light brownish gray and light gray, moderately alkaline very gravelly fine sandy loam; about 40 percent moderately to strongly cemented calcium carbonate fragments; violently effervescent
BCk1—15 to 29 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 67 percent thin platy moderately cemented calcium carbonate fragments, 1 to 3 inches across; violently effervescent
BCk2—29 to 55 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 74 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent
BCk3—55 to 80 inches; white, strongly alkaline extremely gravelly fine sandy loam; about 75 percent thin platy moderately cemented calcium carbonate fragments, 1 to 6 inches across; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 8 to 30 percent
Surface features: None specified
Percent of area covered by surface fragments: 3 to 45 percent coarse subangular gravel
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 2.0 inches (Very low)
Natural drainage class: Well drained
Runoff: Very high
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7s
Land capability irrigated: None specified
Ecological site name: Very Shallow PE 25-36
Ecological site number: R077EY068TX
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a few tallgrasses. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and buffalograss. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, and annual forbs. Yucca, catclaw acacia, ephedra, skunkbush, and feather dalea are the major woody species.

Mobeetie

Landscape: Breaks
Landform: Backslope on scarp slope; backslope on hillslope
Parent material: Calcareous, sandy colluvium and slope alluvium derived from the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 8 inches; grayish brown, moderately alkaline fine sandy loam; about 2 percent nodules of calcium carbonate; strongly effervescent
Bw—8 to 25 inches; light brown, moderately alkaline fine sandy loam; about 2 percent films, threads, and nodules of calcium carbonate; violently effervescent
Bk—25 to 41 inches; pink, moderately alkaline fine sandy loam; about 4 percent films, threads, and nodules of calcium carbonate; violently effervescent
BC—41 to 80 inches; pink, moderately alkaline fine sandy loam; about 3 percent films, threads, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 8 to 45 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately rapid
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 6.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 7e
Land capability irrigated: None specified
Ecological site name: Mixedland Slopes PE 25-36
Ecological site number: R077EY061TX
Typical vegetation: This is a mid and tallgrass site with a large variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from a sandy loam site because the limey topsoil promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used as rangeland and wildlife habitat.
Cropland management: These soils are poorly suited to cropland. The steep slope, droughtiness, high runoff, and low available water capacity are major limitations. The hazard of erosion is severe.
Rangeland management: Native plants yield low amounts of forage. The high carbonate content and very low available water capacity is a major limitation for Potter soils. The slope and runoff is a limitation for both soils. The hazard of erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper

stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: These soils are poorly suited to urban uses. They are very limited as sites for sanitary facilities or building site development. The slope, seepage, droughtiness, gravel, and carbonate content of the soil are major limitations. Overcoming many of these limitations is difficult and costly. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Recreational development: These soils are poorly suited to most recreational uses. The steep slope, gravel content, carbonate content, and low available water capacity of the soil are major limitations.

Wildlife habitat: Arid conditions and low available water capacity are major limitations which restrict plant growth necessary for good habitat. The potential for wind and water erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PnC—Plemons loam, 3 to 5 percent slopes

Map Unit Setting

General location: Southern High Plains, Breaks of western Texas and eastern New Mexico

Major land resource area: 77E

Geomorphic setting: These soils are on gently sloping valley side slopes and erosion remnants along the margins of the southern high plains breaks and on similar hillslope positions along drainageways of Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Plemons and similar soils: 85 percent

Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Plemons soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Plemons are the Berda soils that occur on similar landscape positions.

The contrasting soils are Estacado, Mobeetie, Pep, Potter, and Veal soils. The Estacado and Pep soils are on slightly higher landscape positions. The Mobeetie, Potter, and Veal soils are on similar landscape positions.

Soil Description

Plemons

Landscape: Breaks

Landform: Backslope on valley side; Summit on divide; shoulder on erosion remnant

Parent material: Calcareous, loamy slope alluvium derived mainly from the upper part of the Ogallala Formation of Miocene-Pliocene age.

Typical Profile

A—0 to 6 inches; brown, moderately alkaline loam; violently effervescent
Btk1—6 to 13 inches; brown, moderately alkaline clay loam; about 3 percent films and threads of calcium carbonate; violently effervescent
Btk2—13 to 35 inches; brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; violently effervescent
Btk3—35 to 58 inches; light brown, moderately alkaline clay loam; about 30 percent threads and masses of calcium carbonate; violently effervescent
Btk4—58 to 76 inches; light brown, moderately alkaline clay loam; about 15 percent threads and masses of calcium carbonate; strongly effervescent
Btkb—76 to 80 inches; yellowish red, moderately alkaline clay; about 8 percent threads and masses of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 3 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.7 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: None specified
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077EY057TX
Typical vegetation: This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass species. Buffalograss and sideoats gramas are next in importance. Other midgrasses includes vine mesquite and western wheatgrass. Yucca is the principal woody plant with relatively few forbs present.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Plemons soils are used primarily as rangeland and habitat for wildlife. They are not used extensively as cropland or improved pasture.
Cropland management: This soil is moderately suited to cropland. The high carbonate content of the soil and moderate available water capacity are limitations. The most common crops grown on this soil are wheat and forage sorghum. The hazard of wind erosion is severe. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover

crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited as sites for septic tank absorption fields, roads and streets, or use as roadfill material. The restricted permeability and low soil strength are major limitations. Restricted permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades.

Recreational development: This soil is well suited to recreational uses.

Wildlife habitat: Wind erosion is a potential hazard for the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PrA—Portales clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on nearly level plains or playa steps and occur mainly around playas and along Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Portales and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Portales soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Portales are small areas of Pep soils on similar landscape positions. Also included are small areas of Portales soils that have slopes of 1 to 3 percent.

The contrasting soils are small areas of Drake, Estacado, Lazbuddie, and Lofton soils. Drake soils are on higher landscape positions. The Estacado soils are on similar landscape positions. The Lazbuddie and Lofton soils are on slightly lower landscape positions.

Soil Description

Portales

Landscape: Plateau
Landform: Playa step; plain; interdune
Parent material: Calcareous, loamy lacustrine sediments of Quaternary age.

Typical Profile

A—0 to 15 inches; dark grayish brown, moderately alkaline clay loam; about 2 percent masses of calcium carbonate; violently effervescent
Bw—15 to 35 inches; grayish brown, moderately alkaline clay loam; about 3 percent masses calcium carbonate; violently effervescent
Bk1—35 to 43 inches; light grayish brown, moderately alkaline loam; about 20 percent masses calcium carbonate; violently effervescent
Bk2—43 to 60 inches; white, moderately alkaline clay loam; about 40 percent masses of calcium carbonate; violently effervescent
Bk3—60 to 80 inches; white, moderately alkaline clay loam; about 20 percent masses of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.0 inches (Moderate)
Natural drainage class: Well drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Not ponded
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2e
Ecological site name: Limy Upland PE 25-36
Ecological site number: R077CY028TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are primarily used for cropland. A few areas are used as improved pasture or rangeland.

Cropland management: This soil is moderately suited to cropland. The moderate available water capacity and high carbonate content of the soil are limitations. The hazard of wind erosion is severe. The most common crops grown are cotton and grain sorghum. Other crops include wheat, sunflowers, and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants yield moderate amounts of forage. The high carbonate content and moderate available water capacity of the soil are limitations. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for lawns and landscaping or use as daily cover for landfills. The moderate available water capacity and high carbonate content of the soil are major limitations that can limit plant growth necessary for healthy lawns and landscaping. Low soil strength is a major limitation for the construction of local roads and streets or use as roadfill material. Stabilizing, strengthening, or replacing the base material can overcome many of these restrictions. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is moderately suited to most recreational uses. They are very limited as site for golf course fairways. The moderate available water capacity and high carbonate content of the soil is a major limitation that can restrict plant growth necessary for healthy landscaping and turf.

Wildlife habitat: Wind erosion is a potential hazard for the production of grain and seed crops used for food and cover. The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PuA—Pullman clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico

Major land resource area: 77C

Geomorphic setting: These soils are on nearly level plains and occur throughout most areas of the county.

Map Unit Composition

Pullman and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pullman soil and similar soils make up 93 percent of the map unit, and contrasting soils make up 7 percent.

The soils similar to Pullman are the Pantex and Olton soils that occur on similar landscape positions.

The contrasting soils are small areas of Estacado, Pep, and Portales soils that occur on similar landscape positions,

Also included in mapping are Lofton or McLean soils that occur in very small depressions.

Soil Description

Pullman

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 5 inches; brown, neutral clay loam
Bt1—5 to 18 inches; brown, slightly alkaline clay
Bt2—18 to 33 inches; dark brown, slightly alkaline clay; slightly effervescent
Btk1—33 to 52 inches; brown, moderately alkaline clay; about 2 percent films, threads, concretions, and nodules of calcium carbonate; strongly effervescent
Btk2—52 to 66 inches; strong brown, moderately alkaline clay; about 25 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—66 to 80 inches; reddish yellow, moderately alkaline clay loam; about 40 percent masses, concretions, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.8 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s

Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Pullman soils are used extensively for cropland. A few small areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown on this soil are wheat, grain sorghum, corn, and cotton (fig. 20). Other crops include soybeans and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, septic tank absorption fields, trench sanitary landfills, and use as daily cover for landfills. The high shrink-swell potential, low soil strength, restricted permeability, and high clay content of the soil are major limitations. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to most recreational uses.
Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

Figure 20.—An irrigated field of cotton ready for harvest on a Pullman clay loam, 0 to 1 percent slopes.

PuB—Pullman clay loam, 1 to 3 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on very gently sloping plains and occur mainly on slopes around playas and along Tierra Blanca and Palo Duro Creeks.

Map Unit Composition

Pullman and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pullman soil and similar soils make up 93 percent of the map unit, and contrasting soils make up 7 percent.

The soils similar to Pullman are the Pantex and Olton soils.

The contrasting soils are small areas of Estacado, Pep, and Portales soils that occur on similar landscape positions.

Also included in mapping are Lofton or McLean soils that occur in very small depressions.

Soil Description

Pullman

Landscape: Plateaus or tablelands
Landform: Plain; playa slope

Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 4 inches; brown, neutral clay loam
Bt1—4 to 17 inches; brown, slightly alkaline clay
Bt2—17 to 32 inches; dark brown, slightly alkaline clay; slightly effervescent
Btk1—32 to 51 inches; brown, moderately alkaline clay; about 2 percent films, threads, concretions, and nodules of calcium carbonate; strongly effervescent
Btk2—51 to 65 inches; strong brown, moderately alkaline clay; about 25 percent masses, concretions, and nodules of calcium carbonate; violently effervescent
Btk3—65 to 80 inches; reddish yellow, moderately alkaline clay loam; about 40 percent masses, concretions, and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 3 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.7 inches (High)
Natural drainage class: Well drained
Runoff: High
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 3e
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Pullman soils are used extensively for cropland. A few small areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown on this soil are wheat, grain sorghum, corn, and cotton. Other crops include soybeans and forage sorghum. The main concerns in management are conserving soil moisture and controlling soil erosion (fig. 21). Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and

productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.

Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.

Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, septic tank absorption fields, trench sanitary landfills, and use as daily cover for landfills. The high shrink-swell potential, low soil strength, restricted permeability, and high clay content of the soil are major limitations. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is well suited to most recreational uses.

Figure 21.—Leaving crop residue on the surface after harvest on this Pullman clay loam, 1 to 3 percent slopes, reduces the hazard of erosion and improves soil moisture.

Wildlife habitat: The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

PxA—Pantex silty clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These soils are on nearly level plains and occur along the county line in the north central and northeastern part of the county.

Map Unit Composition

Pantex and similar soils: 95 percent
Contrasting soils: 5 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Pantex soil and similar soils make up 94 percent of the map unit, and contrasting soils make up 6 percent.

The soils similar to Pantex are Olton and Pullman soils that occur on similar landscape positions. Also included are Pantex soils that have a clay loam surface layer, or slopes of 1 to 3 percent.

The contrasting soils are small areas of Estacado, Pep, and Portales soils that occur on similar landscape positions.

Included in mapping are Lofton or McLean soils that occur in very small depressions.

Soil Description

Pantex

Landscape: Plateaus or tablelands
Landform: Plain
Parent material: Clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age.

Typical Profile

Ap—0 to 7 inches; very dark grayish brown, slightly alkaline silty clay loam
Bt1—7 to 20 inches; very dark grayish brown, moderately alkaline silty clay
Bt2—20 to 34 inches; brown, moderately alkaline silty clay
Bt3—34 to 49 inches; brown, moderately alkaline silty clay loam; about 1 percent threads of calcium carbonate; strongly effervescent
Bt4—49 to 71 inches; brown, moderately alkaline silty clay loam; about 1 percent films and threads of calcium carbonate; slightly effervescent
Btk—71 to 80 inches; reddish yellow, moderately alkaline silty clay loam; about 50 percent films, threads, and masses of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified

Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 10.2 inches (High)
Natural drainage class: Well drained
Runoff: Medium
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 3e
Land capability irrigated: 2s
Ecological site name: Deep Hardland PE 25-36
Ecological site number: R077CY022TX
Typical vegetation: The potential natural plant community for this site is shortgrass dominant with a few midgrasses and forbs. Very few shrubs or woody plants occur on this shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant.

Additional information specific to the components of this map unit is available in the "Table" section.

Use and Management

Major land uses: Pantex soils are used extensively for cropland. A few small areas are used as improved pasture or rangeland.
Cropland management: This soil is well suited to cropland. The most common crops grown on this soil are wheat, grain sorghum, corn, and cotton (fig. 22). Other crops include soybeans and forage sorghum The main concerns in management are conserving soil moisture and controlling soil erosion. Fertilizer applications, reduced tillage, high-residue cover crops, and crop residue management can help reduce the soil temperature, conserve moisture, and improve or maintain soil tilth and productivity. Terraces, contour farming, grassed waterways, and diversion terraces, where needed, can help control runoff and water erosion. Improved varieties of bermudagrass and bluestems are the major pasture grasses grown on these soils. Fertilizer applications, weed control, brush management, proper stocking rates, and controlled grazing can help conserve soil moisture and improve or maintain productivity.
Rangeland management: Native plants are dominantly shortgrasses, which produce moderate amounts of forage. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, and septic tank absorption fields. The high shrink-swell potential, low soil strength and restricted permeability are major limitations. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption

Figure 22.—Irrigated corn in an area of Pantex silty clay loam, 0 to 1 percent slopes.

systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.

Recreational development: This soil is well suited to most recreational uses.*Wildlife habitat:* The moderately arid conditions, which can limit plant growth necessary for good habitat, are a minor limitation.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

QcB—Quay loam, 1 to 5 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.

Major land resource area: 70B

Geomorphic setting: These soils are on very gently to gently sloping footslopes and alluvial fans that occur in the northwestern part of the county along the upper Pecos and Canadian valleys and plains and a small area around Lake Garcia.

Map Unit Composition

Quay and similar soils: 85 percent

Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Quay soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Quay are Tucumcari soils that occur on similar landscape positions. Also included in mapping are small areas of Quay soils that have a clay loam surface texture, or slopes less than 1 percent.

The contrasting soils are Berwolf, Glenrio, and Redona soils that occur on similar landscape positions.

Soil Description

Quay

Landscape: Breaks
Landform: Hillslope; footslope on alluvial fan
Parent material: Calcareous, loamy alluvium derived from sandstone and siltstone of, Triassic, and Permian age.

Typical Profile

A1—0 to 3 inches; reddish brown, moderately alkaline loam; slightly effervescent
A2—3 to 9 inches; light reddish brown, moderately alkaline loam; slightly effervescent
Bw—9 to 19 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Bk—19 to 26 inches; reddish brown, moderately alkaline clay loam; about 30 percent masses and nodules of calcium carbonate; violently effervescent
BCk1—26 to 36 inches; light brown, moderately alkaline clay loam; about 25 percent masses and nodules of calcium carbonate; violently effervescent
BCk2—36 to 80 inches; pinkish gray, moderately alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.8 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 4e
Ecological site name: Loamy PE 25-31
Ecological site number: R070EY663TX
Typical vegetation: The potential natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The dominant grass species is usually blue grama. Galleta and buffalograss are next in importance. The site resembles a clay loam ecological site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The site typifies a shortgrass/midgrass prairie.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Quay soils are used primarily as rangeland and habitat for wildlife. These soils are not used for cropland or improved pasture in this county.
Cropland management: These soils are moderately suited to cropland. Arid conditions and moderate available water capacity are limitations. The hazard of wind erosion is severe.
Rangeland management: Native plants are dominantly short and midgrasses, which produce moderate amounts of forage. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are well suited to most urban uses. They are very limited as a site for local roads and streets because of soil strength. Because of low soil strength, special treatment is necessary to increase the stability of road subgrades. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of both these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to recreational uses. Dustiness is somewhat limiting. Recreational areas may require water or special surfacing material during dry periods to prevent excessive dustiness due to heavy foot traffic.
Wildlife habitat: The arid conditions are a major limitation that can restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

RaA—Randall clay, 0 to 1 percent slopes, frequently ponded

Map Unit Setting

General location: Southern High Plains of western Texas and eastern New Mexico
Major land resource area: 77C
Geomorphic setting: These nearly level soils are on the floor of playa basins and occur in scattered areas throughout the county.

Map Unit Composition

Randall and similar soils: 90 percent
Contrasting soils: 10 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Randall soil and similar soils make up 95 percent of the map unit, and contrasting soils make up 5 percent.

The soils similar to Randall are the McLean soils that occur on similar landscape positions. Also included are small areas of Randall soils that have a loamy overburden of soil material that has eroded from surrounding soils.

The contrasting soils are Estacado, Lazbuddie, Lofton, Pep, and Portales soils. Estacado, Pep, and Portales soils are on higher landscape positions. The Lazbuddie and Lofton soils occur on similar but slightly higher landscape positions.

Soil Description

Randall

Landscape: Plateau
Landform: Playa floor
Parent material: Clayey lacustrine sediments of Quaternary age.

Typical Profile

A1—0 to 3 inches; very dark gray, slightly acid clay
A2—3 to 9 inches; very dark gray, neutral clay
Bw—9 to 17 inches; very dark gray, neutral clay
Bss1—17 to 38 inches; very dark gray, neutral clay
Bss2—38 to 62 inches; dark gray, neutral clay; about 1 percent masses and nodules of calcium carbonate; slightly effervescent
Bkss—62 to 80 inches; dark grayish brown, moderately alkaline clay; about 3 percent masses and nodules of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Very slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)
Natural drainage class: Poorly drained
Runoff: Negligible
Annual flooding: None
Annual ponding: Frequent
Depth to seasonal high water table: Present within 80 inches

Interpretive Groups

Land capability nonirrigated: 6w
Land capability irrigated: None specified
Ecological site name: Playa PE 25-36
Ecological site number: R077CY027TX
Typical vegetation: The potential natural plant community of a playa is highly variable and dependent on the hydrology of the playa basin being considered. The dominance of hydrophytic plants or upland plants depends on the degree, frequency, and time of inundation. Vegetation varies according to the amount of water available during the growing season. On average years, this site is usually inundated and saturated for longer periods. The potential natural plant community is dominantly a mixture of hydrophytic forbs, grasses, and grasslike plants. The most prevalent species on the site is creeping spikerush, Pennsylvania smartweed, saltmarsh aster, bur ragweed, curly dock, bushy knotweed, and sedges. Varying amounts of grasses are present and include knotgrass, barnyard grass, and western wheatgrass. In areas of standing water, southern cattail, softstem bulrush, and spiked arrowhead may be present.

Occasionally there will be a few willows and cottonwoods present around the periphery of the playa.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: These soils are used primarily for wildlife habitat. A few areas are used as rangeland.

Cropland management: This soil is poorly suited to cropland. The frequent ponding, wetness, depth to saturated zone, and clayey texture of the soil, which can restrict root development are major limitations.

Rangeland management: Frequent ponding is a major limitation and prolonged periods of inundation decrease productivity (fig. 23). Large areas of bare ground are common after extended periods of ponding and require time to reestablish native vegetation. The dominant plant species on these soils yield poor quality forage for livestock use. Proper stocking rates, brush management, and controlled grazing can help improve productivity.

Urban development: This soil is poorly suited to urban uses. They are very limited a site for sanitary facilities and building site development. The depth to a saturated zone, frequent ponding, high clay content, restricted permeability, high shrink-swell potential, and low strength are major limitations. Overcoming these limitations is difficult and costly. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel. Under certain conditions, trench sidewalls can become highly unstable in this soil. Trenches that have been excavated to more than a depth of 5 feet should be shored or the sidewall should be graded to an angle that ensures safe working conditions.

Figure 23.—An area of Randall clay, 0 to 1 percent slopes, frequently ponded. These soils occur on the floor of playa basins. These playas provide seasonal water and wildlife habitat.

Recreational development: This soil is poorly suited to recreational uses. The depth to a saturated zone, frequent ponding, and high clay content of the soil is very limiting.
Wildlife habitat: The clayey surface texture, shallow water table, and frequent ponding are major limitations that affect plant growth necessary for good habitat. Dove, pheasant, and quail make limited use of this habitat for food and cover. When ponded, these soils are preferred sites for waterfowl, such as ducks and geese, that use these areas for food, water, and cover.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

RfC—Redona fine sandy loam, 1 to 5 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.
Major land resource area: 70B
Geomorphic setting: These soils are on very gently to gently sloping hillslopes, terraces, and alluvial fans that occur along the upper Pecos and Canadian valleys and plains in the northwestern corner of the county.

Map Unit Composition

Redona and similar soils: 80 percent
Contrasting soils: 20 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Redona soil and similar soils make up 85 percent of the map unit, and contrasting soils make up 15 percent.

The soils similar to Redona are the Berwolf soils that occur on similar landscape positions. Also included in mapping are small areas of Redona soils that have a loamy fine sand surface texture, or slopes less than 1 percent.

The contrasting soils are Glenrio, Ima, Lacoca, Tucumcari, and Quay soils. Ima and Quay soils are on similar landscape positions. The Glenrio and Lacoca are on slightly higher landscape positions. Tucumcari soils occur on slightly lower landscape positions.

Soil Description

Redona

Landscape: Breaks
Landform: Tread on terrace; footslope on alluvial fan; summit on hillslope
Parent material: Loamy slope alluvium over calcareous residuum weathered from sandstone and shale of Triassic age

Typical Profile

A—0 to 10 inches; reddish brown, slightly alkaline fine sandy loam
Bt1—10 to 24 inches; reddish brown, slightly alkaline sandy clay loam
Bt2—24 to 28 inches; reddish brown, slightly alkaline sandy clay loam; about 1 percent masses of calcium carbonate; strongly effervescent
Bk1—28 to 50 inches; pink, strongly alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent
Bk2—50 to 80 inches; light reddish brown, moderately alkaline clay loam; about 2 percent masses and nodules of calcium carbonate; violently effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 1 to 5 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderate
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 8.4 inches (Moderate)
Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4e
Land capability irrigated: 4e
Ecological site name: Sandy Loam
Ecological site number: R070XB054NM
Typical vegetation: The potential natural plant community is a mixture of short and midgrasses with a smaller tallgrass complement. Midgrasses, tend to dominate over most of the site with sideoats grama being the most prevalent midgrass species. Blue grama is the dominant shortgrass species and little bluestem the dominant tallgrass species. Small areas may occur within the site where blue grama is more prevalent. Woody plants are few but include yucca, catclaw acacia, and sand sage.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Redona soils are used primarily as rangeland and habitat for wildlife. These soils are not used for cropland or improved pasture in this county.
Cropland management: These soils are moderately suited to cropland. Arid conditions and moderate available water capacity are limitations. The hazard of wind erosion is severe.
Rangeland management: Native plants produce moderate amounts of forage. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: These soils are well suited to most urban uses.
Recreational development: This soil is well suited to most recreational uses.
Wildlife habitat: The arid conditions are a major limitation that can restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

TuA—Tucumcari clay loam, 0 to 1 percent slopes

Map Unit Setting

General location: Upper Pecos and Canadian Valleys and Plains of the western edge of the Texas Panhandle and eastern New Mexico.
Major land resource area: 70B
Geomorphic setting: These soils are on nearly level alluvial flats, alluvial fans, and swales that occur along the upper Pecos and Canadian valleys and plains in the northwestern corner of the county. A small area of these soils also occurs around Garcia Lake in the western part of the county.

Map Unit Composition

Tucumcari and similar soils: 85 percent
Contrasting soils: 15 percent

Based on transect data and other field observations of the map unit during the survey, the best estimate is that the Tucumcari soil and similar soils make up 90 percent of the map unit, and contrasting soils make up 10 percent.

The soils similar to Tucumcari are the Quay soils that occur on similar landscape positions.

The contrasting soils are the Berwolf, Glenrio, and Redona soils that occur on slightly higher landscape positions.

Soil Description

Tucumcari

Landscape: Breaks
Landform: Talf on alluvial flat; rise on alluvial fan; dip on swale
Parent material: Calcareous, clayey alluvium derived from sandstone and shale of Triassic and Permian age.

Typical Profile

A—0 to 5 inches; reddish brown, moderately alkaline clay loam; strongly effervescent
Btk1—5 to 16 inches; reddish brown, moderately alkaline clay; about 3 percent disseminated calcium carbonate; strongly effervescent
Btk2—16 to 30 inches; reddish brown, moderately alkaline clay; about 3 percent disseminated calcium carbonate; strongly effervescent
Btk3—30 to 45 inches; reddish brown, moderately alkaline clay; about 2 percent threads of calcium carbonate; strongly effervescent
Bk—45 to 80 inches; reddish brown, moderately alkaline clay loam; about 2 percent threads of calcium carbonate; strongly effervescent

A complete soil description with range in characteristics is included, in alphabetical order, in the "Soil Series and Morphology" section.

Properties and Qualities

Slope: 0 to 1 percent
Surface features: None specified
Percent of area covered by surface fragments: None specified
Depth to restrictive feature: None
Slowest permeability class in the soil profile: Moderately slow
Salinity: Not saline within 40 inches
Sodicity: Not sodic within 40 inches
Available water capacity: About 9.2 inches (High)

Natural drainage class: Well drained
Runoff: Low
Annual flooding: None
Annual ponding: None
Depth to seasonal high water table: Not present within 80 inches

Interpretive Groups

Land capability nonirrigated: 4s
Land capability irrigated: None specified
Ecological site name: Clayey PE 25-31
Ecological site number: R070XB662NM
Typical vegetation: The potential natural plant community for this site is shortgrass and midgrasses with a few forbs. Very few woody plants occur except occasional cholla. It is a shortgrass prairie. The most prevalent grasses are tobosa, alkali sacaton, blue grama, and buffalograss with tobosa being most prevalent.

Additional information specific to the components of this map unit is available in the “Table” section.

Use and Management

Major land uses: Tucumcari soils are used primarily as rangeland and habitat for wildlife. These soils are currently not used for cropland or improved pasture.
Cropland management: These soils are moderately suited to cropland. Arid conditions are a limitation. The hazard of wind erosion is severe.
Rangeland management: Native plants are dominantly short and midgrasses, which produce moderate amounts of forage. The hazard of wind erosion is severe. The main concerns in management are continuous overgrazing, fire suppression, and invasion of woody species and undesirable perennial grasses or annual forbs. Proper stocking rates, brush management, and controlled grazing can help improve or maintain productivity.
Urban development: This soil is moderately suited to most urban uses. They are very limited as a site for small commercial buildings, dwellings without basements, local roads and streets, and septic tank absorption fields. The high shrink-swell potential, low soil strength and restricted permeability are major limitations. The shrink-swell can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other non-expansive material can minimize the structural damage caused by shrinking and swelling of the soils. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. Pipelines, storage tanks, and other underground structures made of uncoated steel should be protected from the high corrosion potential of these soils. This can be overcome by providing cathodic protection or by using galvanized steel.
Recreational development: This soil is well suited to recreational uses.
Wildlife habitat: The arid conditions are a major limitation that can restrict plant growth necessary for good habitat. The potential for wind erosion is severe.

For more information about managing this map unit, see the section on "Soil Properties," and the section on "Use and Management" which includes subsections on "Crops and Pasture," "Engineering," "Rangeland," "Recreation," and "Wildlife Habitat."

W—Water

A small, natural or constructed lake, pond, or pit that contains water most of the year. It is typically 5 to 40 acres in size and used mainly for livestock water, migratory waterfowl, and other wildlife.

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-range 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, forestland, 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. Slope ranges 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 666,108 acres in the survey area, or 70 percent of the total acreage, meets the soil requirements for prime farmland. This land occurs throughout the county, mainly in general soil map units 1, 3, 5, and 9, which are described under the heading "General Soil Map Units." About 620,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly wheat, cotton, grain sorghum, corn, and forage sorghum, account for an estimated 10 percent of the county's total agricultural income each year (1997 Census).

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed at the end of this section. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for prime farmland are:

BcA—Bippus clay loam, 0 to 2 percent slopes, occasionally flooded (Prime farmland if protected from flooding or not frequently flooded during the growing season)
EcA—Estacado clay loam, 0 to 1 percent slopes
FrB—Friona loam, 1 to 3 percent slopes (Prime farmland if irrigated)

LcA—Lazbuddie clay, 0 to 1 percent slopes
LoA—Lofton clay loam, 0 to 1 percent slopes
OcA—Olton clay loam, 0 to 1 percent slopes
OcB—Olton clay loam, 1 to 3 percent slopes
PuA—Pullman clay loam, 0 to 1 percent slopes
PuB—Pullman clay loam, 1 to 3 percent slopes
PxA—Pantex silty clay loam, 0 to 1 percent slopes

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 forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; for agricultural waste management; and as 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, slightly limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately well 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

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

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 the Cooperative Extension Service.

Management of Cropland

About 637,348 acres in the county is in cropland. About 227,250 acres is irrigated each year. The rest of the cropland is non-irrigated.

The major non-irrigated crops include wheat, cotton, and grain sorghum. The major irrigated crops are also cotton and grain sorghum, and, in addition, corn and a few areas of soybeans. Corn and cotton are the most important of the cash crops grown in irrigated areas.

Irrigation water is drawn from wells in the Ogallala Aquifer. Both surface (furrow) and sprinkler irrigation systems are used. Most of the surface systems are on nearly level cropland areas and are used less commonly than sprinkler systems. Sprinkler systems throughout the county are mainly center-pivot (fig. 24).

Figure 24.—Center pivot irrigation on fields of corn and cotton.

Irrigation water management is important because of the high cost of pumping water and the need to conserve the water in the Ogallala Aquifer. Irrigation water should be applied at the proper times and in the amounts required by the crop. The timing of irrigation can be determined by the feel and appearance method; by moisture monitoring devices, such as gypsum blocks and tensiometers; and by the moisture accounting method. Crop needs for various growth stages can be determined from consumptive use curves. Irrigation water should be distributed evenly to all parts of the field. Annual or biennial evaluations of surface and sprinkler irrigation systems are recommended in order to locate inefficiencies in distribution. Where surface systems are used, land leveling, land grading, shortening of irrigation runs, surge irrigation systems, and cutback head irrigation systems can increase the efficiency of water distribution. Replacing worn nozzles can increase the efficiency of sprinkler systems. In addition, operating the systems at the pressures recommended by manufacturers or distributors can ensure a high degree of efficiency.

Table 24 provides information on the ratings of the soils for irrigation of different types.

In all areas of cropland, soil and water conservation are important management concerns. Crop residue management and other measures, such as furrow diking, contour strip cropping, field strip cropping, wind strip cropping, cover cropping, contour farming, and terracing, help to control wind erosion and water erosion, conserve moisture, and maintain or improve tilth. Measures that conserve moisture generally result in higher crop yields.

Crop residue management includes crop residue use, delayed seedbed preparation, and conservation tillage. Leaving crop residue on the surface helps to protect the soil against wind erosion; minimizes soil crusting and the detachment of soil particles, and thus helps to control runoff and water erosion; reduces the rate at which soil moisture evaporates; improves tilth in the surface layer; and minimizes compaction by farm machinery.

Tillage should be sufficient to prepare a good seedbed and to control weeds without damaging the structure of the soil. Heavy traffic on the soil, especially during wet periods, can cause the formation of a compaction pan by destroying soil structure. Compaction reduces soil porosity and restricts root growth into and through the compacted layer. It limits the ability of the root system of a crop to take up moisture and nutrients. It also increases the amount of moisture and nutrients lost through runoff and erosion. Deep chiseling and controlled traffic patterns can minimize compaction. Roughening the surface through emergency tillage helps to control wind erosion.

Properly applied fertilizer is needed on all cultivated soils. Soil analysis and knowledge of the history of fertilizer application on a field can help in making accurate estimates of the kind and amount of nutrients needed to produce a specific yield. An annual soil analysis can detect a buildup or depletion of required nutrients for each crop. In addition, plant analyses can be used to determine nutrient deficiencies in a growing crop.

Management of Pasture and Hayland

Pasture and hayland make up about 2,373 acres in the county. About 1,145 acres is irrigated each year and the remainder is non-irrigated.

Management of pasture and hayland includes selecting plants that are suited to the soil, applying fertilizer, managing grazing heights for maximum productivity, rotating pastures, and controlling weeds and brush. Efficient water management is important in areas where pasture or hayland is irrigated.

Many highly productive grasses are suitable for improved pasture. The most widely used grasses are kleingrass and improved bermudagrass. Improved bermudagrasses are the most widely grown grasses in areas of irrigated pasture.

Applying fertilizer or planting soil-improving leguminous crops is essential for economical forage production in areas of irrigated pasture and hay. In areas of non-irrigated pasture, fertilizer should be applied when the moisture supply is adequate. All fertilizer should be applied according to the results of soil or plant analysis.

Rotating pastures for proper grazing use is an important management practice. Timely rotation allows for the maximum production of improved grasses. Weeds can be controlled by mowing, by prescribed burning, or by applying approved herbicides.

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 5. 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 map units in the survey area 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 also are 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 5 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 forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit.

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

Class 1 soils have slight limitations that restrict their use.

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

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

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

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

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, forestland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

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 6, table 7, and table 8 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. *Slightly limited* indicates that the soil has features that are generally favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and 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 0.00 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.

Large Animal Carcass Disposal

Large animal disposal, pit, and large animal disposal, trench, are methods of disposing of dead animals by placing the carcasses in successive layers in an excavated pit or trench. The soil is evaluated from the surface to a depth of 79 inches. Onsite investigation to a greater depth will be needed for final site acceptance. The ratings are based on the soil properties that affect attenuation of suspended, soil solution, and gaseous decomposition products and micro-organisms; construction and maintenance of the site; and public health. Improper site selection, design, or installation may cause contamination of ground water, seepage, and contamination of stream systems from surface drainage or floodwater.

The soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations. Pollution is a hazard on soils that are subject to flooding or have a water table within the depth of excavation. These soils cannot be easily excavated. Soils that have high saturated hydraulic conductivity (K-sat) or are shallow to bedrock, ice, a cemented pan, or stones and boulders are limited because these features interfere with the installation, performance, and maintenance of the system. Slope affects road construction, performance of the roads, and the control of surface water around the trench. Also, it can cause difficulty in construction where the trench or pit bottom must be kept level and oriented to follow the contour of the land.

The ease with which the trench or pit is dug and with which a soil can be used as daily and final cover is based largely on soil texture and consistence, which affect workability, both when the soil is dry and when it is wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and difficult to place as a uniformly thick cover over a layer of carcasses. The uppermost part of the final cover should be soil material that favors the growth of plants. It should not contain excess sodium or salts and should not be too acid. In comparison with other horizons, the surface layer in most soils has the best workability and the highest content of organic matter. Thus, it may be desirable to stockpile the surface layer for use in the final blanketing of the fill.

Table 9 shows the degree and kind of limitations that affect the disposal of large animal carcasses by the pit or trench method. 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 of a properly designed and installed system. *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 the individual limitations. The ratings are shown in 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).

Rangeland

J.R. Bell, Rangeland Management Specialist, Amarillo, Texas, prepared this section.

Rangeland is land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. This includes rangelands in their native state and rangelands that may have been restored by the reseeding of native plants and are being managed now as native rangelands. Plant communities on rangelands are closely related to the kind of soils present. In order to understand and to effectively manage rangeland ecosystems, there must be a good understanding of the interaction between soils, plants, grazing animals, and water.

In the detailed map unit descriptions, the potential natural plant community (also referred to as historic climax) that grows on each map unit is described. A potential natural plant community is an association of plants that are best adapted to the environmental factors of soil, topography, and climate present on a particular site. These plants developed over centuries and have reached equilibrium in relation to the other factors. These communities are stable with some minor variations due to yearly growing conditions. The historic climax is not static, but the fluctuations are not drastic. In general, the potential natural plant community in the same major land resource area on the same soil will be very similar.

A term used to characterize distinctive kinds of rangeland is the “ecological site” (sometimes called range site). These “sites” produce different natural plant communities than do other “sites.” There will be differences in species, amounts, and proportions of plants from site to site. There are generally a few major species, which characterize a particular site. These are listed under the map unit descriptions. Not every soil is a different ecological site; similar soils will often be in the same site.

As a part of the preparation of a complete resource inventory, it is useful to know if the plant community has undergone changes over time. Many years of livestock grazing, the absence of natural fires, invasion of plants not originally present in pristine times, and climatic events such as major droughts have all interacted to affect changes in vegetation on our native rangelands. While some of our rangelands have remained very productive and very similar to what they were two hundred years ago, most of the range has declined from its original potential.

How a range is managed will affect the nature of the vegetation as to production, species composition, plant health, and its potential to protect the soil. If grazing is too severe for an extended period, the vigor of individual plants will decline and overall productive capacity will be reduced. Often the more palatable vegetation receives undue pressure and these species begin to disappear. Less desirable species will fill the void and the appearance of the range changes, as well as its capacity to sustain a certain level of stocking. Strong, perennial species may be replaced by weaker perennials or annual species. Stability is affected and the plant community is unable to withstand the extreme climatic variations. Opportunistic brushy and weedy plants often make an appearance. Generally, this process takes place gradually over many years, and the degradation process may take more than one pathway. This is because no two sites are going to respond exactly the same way. Site resilience is different and climatic factors influence the process in ways difficult to predict. Soil deterioration may be accelerated as the plant community declines in stability and in its ability to protect the soil surface. Erosion is increased, lowering productivity even more.

However, many degraded rangelands can be restored through good grazing management practices alone. Prescribed grazing, that is, using an appropriate stocking rate of animals for a specific time followed by a recovery period or “rest,” is the most needed practice on all native rangelands. The sequence of graze-rest may need adjusting from year to year. In addition, stocking rates need to remain flexible since production of the range is variable. There are other practices used to sustain or improve rangeland productivity. The more common ones are: brush management where woody plants have increased to problem densities and are threatening the overall balance of the site; livestock watering systems to better distribute grazing or browsing; cross-fencing to more efficiently graze larger units of rangeland; and rangeland re-seeding where natural plant communities have deteriorated and an insufficient seed source remains. All these practices should be applied as a part of an overall resource management plan. The planning process consists of planning, monitoring, and re-planning constantly on a year-to-year basis.

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation 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 vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. 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 that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the 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 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 in a well managed area 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," which is available in local offices of the Natural Resources Conservation Service.

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.

Importance of Rangelands

The rangeland livestock industry is very important to West Texas agriculture. Native rangelands serve as the foundation of the industry. Not only do rangelands support livestock grazing; they also provide valuable wildlife habitat, recreational opportunities, and watersheds for the lakes, rivers, and streams. This survey area contains about 958,253 acres of which 32.8 percent or 314,198 acres are range or other grazing lands (USDA, 2002). The size of range units varies from small to very large. Both cow-calf and stocker operations are common. The region, including the Texas Panhandle and South Plains, is part of the largest cattle feeding area in the United States. Locally grown grain crops help sustain this industry, enhancing the area’s cropland-agriculture enterprises. Many stocker cattle are pastured on small grain during fall and winter months and are then put in feedlots or grass pasture.

The climate of the region is generally well suited to ranching. In the winter months, cold fronts are frequent in which temperatures drop into the teens or occasionally lower. These fronts may bring snow and ice; however, these periods do not last long. Feeding of hay and supplement in the winter months is necessary. The common supplementation is protein in the form of cottonseed cake or grain cubes. Mineral blocks are often left out year-round. There is little cool-season grass production, and most of the production on the native rangeland occurs from May through October.

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

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

Ecological Sites

The county has 15 ecological sites. These are Bottomland, Clayey, Deep Hardland, Draw, Hardland Slopes, High Lime, Limy Upland, Loamy, Mixedland Slopes, Playa, Red Shale, Sandy Loam, Sandy Plains, Shale Sandstone, and Very Shallow.

Bottomland ecological site. Minneosa soils in map unit MNA are in this ecological site.

The composition, by weight, is about 65 percent grasses, 20 percent forbs, and 15 percent shrubs.

This is a tallgrass climax. Nearly half of the grass component is composed of tallgrasses, such as sand or big bluestem, alkali sacaton, indiangrass, and switchgrass. The remainder of grass vegetation is mid and shortgrasses such as little bluestem, wildryes, western wheatgrass, sand dropseed, and fall witchgrass. Forbs make up from 10 to 20 percent of the total herbaceous vegetation and include Maximilian sunflower, heath aster, and bundleflowers. Woody shrubs, namely soapberry, skunkbush, daleas, sand plum, hackberry, and cottonwood, make up 5 to 20 percent of the plant community.

Under heavy grazing the tallgrass species decline, with brush and midgrasses filling the void. With further abuse weedy species, such as western ragweed, heath aster, and annuals, make up more than half of the yearly production. Sometimes the soapberry, pricklyash, daleas, sand plum, hackberry, and cottonwood can form more than a 30 percent canopy.

Clayey ecological site. Tucumcari soils in map unit TuA are in this ecological site (fig. 25).

The composition, by weight, is about 88 percent grasses, 8 percent forbs, 2 percent cryptogams, and 2 percent shrubs.

The natural plant community for this site is a shortgrass and midgrass community, with a few forbs. Almost no shrubs or woody plants occur except a few cholla. It is a shortgrass prairie. The most prevalent grasses are tobosa, alkali sacaton, blue grama and buffalograss with tobosa being most dominant. In excellent condition the shortgrasses make up 40 to 50 percent of the total plant community. The midgrass component will make up 40 to 45 percent of the total and will consist mainly of sideoats grama, western wheatgrass, vine mesquite, and tobosa. Other species will occur in small amounts, and will together make up 10 percent or less of the total production. These are sand dropseed, tumble windmillgrass, sand muhly, silver bluestem, and galleta. Forbs are moisture dependent and are most abundant during above-average rainfall years. The forbs will make up 5 percent or less of total production.

Under heavy grazing, sideoats grama, western wheatgrass, and vine mesquite will decline and will eventually disappear from the site. Buffalograss and tobosa will increase. Eventually with prolonged abuse the site will deteriorate to stunted buffalograss, clumpy tobosa, sand muhly, sand dropseed, and a variety of weedy grasses and annual forbs.

Figure 25.—Typical area of the Clayey ecological site on the Tucumcari soil in the Tucumcari clay loam, 0 to 1 percent slopes, map unit.

Deep Hardland ecological site. The Estacado, Friona, Lazbuddie, Lofton, Olton, Pantex, and Pullman soils in map units EcA, FrB, LcA, LoA, OcA, OcB, PuA, PuB, and PxA are in this ecological site.

The composition, by weight, is about 88 percent grasses, 8 percent forbs, and 2 percent cryptogams, and 2 percent shrubs.

The natural plant community for this site is dominantly shortgrass with a few midgrasses and a few forbs. Almost no shrubs or woody plants occur. It is a shortgrass prairie. The most prevalent grasses are blue grama and buffalograss with blue grama being dominant. In excellent condition, the shortgrasses make up 65 to 80 percent of the total plant community. The midgrass component will be less than 20 percent of the total and will consist mainly of western wheatgrass or vine mesquite. On the more loamy soils of this site sideoats grama will likely occur. Other species will occur in minute amounts, and will together make up 10 percent or less of the total production. These are sand dropseed, tumble windmillgrass, sand muhly, silver bluestem, tobosa, and galleta. Forbs are moisture dependent and are most abundant during above-average rainfall years. The forbs will make up 5 percent or less of total production.

Under heavy grazing sideoats grama, western wheatgrass, and vine mesquite will decline and will eventually disappear from the site. The blue grama will take on a sod-bound appearance to escape grazing pressure. Buffalograss will increase and a generally low vigor, low production situation will prevail. Eventually with prolonged abuse, the site will deteriorate to stunted buffalograss, perennial threeawn, sand muhly; sand dropseed, and a variety of weedy grasses and annual forbs.

Draw ecological site. Bippus soils in map unit BcA are in this ecological site. The composition, by weight, is about 90 percent grasses, 5 percent forbs, 1 percent cryptogams, and 4 percent shrubs.

The natural plant community is dominantly midgrasses with lesser amounts of both tall and shortgrass species. A few forbs occur along with a few woody plants. These sites catch runoff from surrounding shortgrass sites. The dominant species are western wheatgrass, vine mesquite, and sideoats grama. Blue grama and buffalograss always make up the most of the shortgrass complement. In general, midgrasses make up 50 percent of the total herbage with shortgrasses making up from 15 to 25 percent. In instances where soil and moisture conditions are more favorable, tallgrasses will be found such as switchgrass and indiangrass. These are generally less than 15 percent of the total site composition. There are a few forbs present but they tend to be obscured by the thick grass growth. The number of shrubs and trees are relatively few, and they occur intermittently.

Under heavy grazing tallgrass species disappear and the western wheatgrass and vine mesquite eventually give way to increased amounts of blue grama and buffalograss. Continued abuse will finally lead to a shortgrass dominated site with weedy invasion and low vigor production. Prickly pear will often invade along with mesquite and other undesirable woody plants if seed sources are present.

Hardland Slopes ecological site. Berda soils in map units BeD, BpD, and BVD are in this ecological site (fig. 26).

The composition, by weight, is about 81 percent grasses, 8 percent forbs, 3 percent cryptogams, and 8 percent shrubs.

This is a transitional site dominated by shortgrass with a significant midgrass component. Blue grama is the dominant grass, making up 50 percent or more of the total production. Buffalograss and sideoats grama are next in importance. Other midgrasses are vine mesquite and western wheatgrass, which occur in micro-lows where moisture collects. This site is very productive if runoff can be minimized. If the area is heavily grazed, cover is not sufficient to retard runoff, and the slopes carry it away rapidly. Yucca is the principal woody plant with relatively few forbs being present. This site is subject to gully erosion if cover is poor.

Figure 26.—Typical area of the Hardland Slopes ecological site on the Berda soil in the Berda loam, 3 to 5 percent slopes, map unit.

Under heavy grazing on a sustained basis, this site will become completely dominated by shortgrasses. This will result in a sod-bound blue grama and buffalograss condition. In later stages of degradation an invasion of weedy species, such as broom snakeweed, and annual grasses, such as little barley, occurs. Prickly pear can also invade along with mesquite in certain locations where a seed source is available.

High Lime ecological site. Drake soils in map unit DRC are in this ecological site.

The composition, by weight, is about 84 percent grasses, 5 percent forbs, and 1 percent cryptogams, and 10 percent shrubs.

This is a mid and tallgrass site with a lesser shortgrass complement and a few woody plants. Forbs also occur but are not abundant. Grasses that are tolerant of the calcareous conditions dominate the site. Sideoats grama, blue grama, vine mesquite, western wheatgrass, and alkali sacaton are the more common species. Fourwing saltbush will often be present, and a few cholla plants can occur on parts of the site. This site is not commonly a preferred grazing area because of the high lime content in the soil. Palatability is lower on this site because of the calcareous soil conditions. If overgrazed the blue grama and sideoats grama will decrease and alkali sacaton and inland saltgrass will increase. If long-term abuse takes place the site will exhibit large patches of bare ground, numerous annuals, and broom snakeweed. Prickly pear and shrubby mesquite can also invade the site if abuse is prolonged.

Limy Upland ecological site. Pep, Plemons, Portales, and Veal soils in map units BVD, MVE, PcA, PcB, PcC, PnC, and PrA are in this ecological site (fig. 27).

The composition, by weight, is about 81 percent grasses, 8 percent forbs, 3 percent cryptogams, and 8 percent shrubs.

The natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The site resembles a clay loam site except for the presence of more midgrasses such as sideoats grama, western wheatgrass, and vine mesquite. The dominant grass is generally blue grama. The site typifies a shortgrass and

Figure 27.—Typical area of the Limy Upland ecological site on the Veal soil in the Berda-Veal association, 3 to 8 percent slopes.

midgrass prairie. Shortgrasses make up 60 percent or more of the grass complement, with midgrasses making up 20 to 25 percent. Forbs will comprise as much as 8 percent of the total community and shrubs will make up about 5 percent.

Under heavy grazing the midgrasses will decline and eventually disappear. Blue grama will become more sod-bound and buffalograss will increase. Production will decline dramatically with continued abuse and low-vigor plants will result.

Loamy ecological site. Quay soils in map units GQE, and QcB are in this ecological site.

The composition, by weight, is about 80 percent grasses, 8 percent forbs, 3 percent cryptogams, and 9 percent shrubs.

The natural plant community for this site is dominantly shortgrass and midgrasses and only a few woody species. The most prevalent grasses are blue grama, buffalograss, tobosa, along with smaller amounts of sideoats grama and vine mesquite. Cholla is the major woody species along with yucca and hackberry. The site typifies a shortgrass and midgrass prairie. Shortgrasses make up 60 percent or more of the grass complement, with midgrasses making up 20 to 25 percent. Forbs will comprise as much as 7 percent of the total community and shrubs will make up about 8 percent.

Under heavy grazing the midgrasses will decline and eventually disappear. Blue grama will become more sod-bound and buffalograss will increase. Production will decline dramatically with continued abuse and low-vigor plants will result.

Mixedland Slopes ecological site. Mobeetie soils in map units MoC, MoD, MVE, and PMG are in this ecological site (fig. 28). The composition, by weight, is about 78 percent grasses, 10 percent forbs, and 10 percent shrubs, and 2 percent cryptogams.

This is a mid and tallgrass site with a good variety of forbs and a smaller woody plant component. Major grass species are little bluestem, sideoats grama, sand bluestem, and blue grama. This site differs from the sandy loam site in that the calcareous topsoil

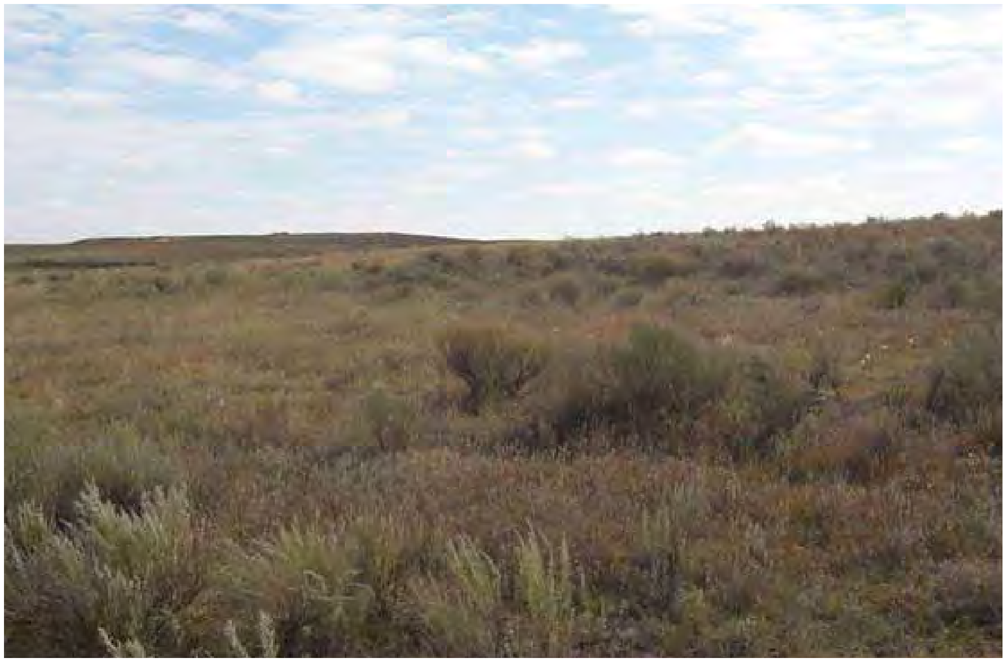

Figure 28.—Typical area of the Mixedland Slopes ecological site on the Mobeetie soil in the Mobeetie fine sandy loam, 3 to 5 percent slopes, map unit.

promotes an increased growth of sideoats grama and little bluestem. Sand sagebrush is the major woody species along with yucca and skunkbush.

Under heavy grazing, the tallgrasses disappear and blue grama increases along with sand sagebrush. Further deterioration will see midgrasses declining and sagebrush forming a 20 percent or more canopy. In poor condition perennial threeawn, buffalograss, annuals, and ragweed typify the vegetation along with a moderate canopy of sagebrush. The productive potential declines rapidly as range condition deteriorates.

Playa ecological site. McLean and Randall soils in map units McA and RaA are in this ecological site. The composition, by weight, is about 49 percent grasses, 50 percent forbs, and 1 percent shrubs.

The natural plant community is highly variable depending on the hydrology of the particular playa lake being considered. There is commonly a mixture of hydrophytic plants and upland plants but this depends on the degree and frequency of inundation. The larger, deeper playa basins that receive more runoff are generally inundated for longer periods and are dominated by hydrophytic plants such as rushes, spike sedges and spike rushes, smartweed, arrowhead, and curly dock. The small, shallow playas and areas adjacent to the deeper playa basins can be dominantly grass vegetation such as western wheatgrass, vine mesquite, buffalograss with a few forbs such as asters, coreopsis, bur ragweed, lambs quarter, and annual forbs. The degree of diversity is variable and no two playas are exactly alike. It is difficult to describe a true climax community as the periods of inundation vary in frequency and longevity, and this site is in a constant state of change. This site has very few shrubs, and these generally occur around the periphery of the wetter playa basins. If playas are inundated through the growing season and then dry up in the fall, they may be bare during the following winter and early spring and can be subject to wind erosion until plants emerge in the summer.

Under heavy grazing the more productive grasses and grasslike species will decrease and annual, bursage, blueweed and other unpalatable species will increase. Smartweed is also quite palatable and can decrease if heavy grazing persists. Normally the amount and frequency of inundation affects the plant community more than grazing does.

Red Shale ecological site. Glenrio soils in map unit GQE are in this ecological site.

The composition, by weight, is about 73 percent grasses, 15 percent forbs, 4 percent cryptogams, and 8 percent shrubs.

The natural plant community is a mixture of shortgrasses and midgrasses. Vegetation consists of sparse stands of blue grama, little bluestem, sideoats grama, buffalograss, galleta, and perennial threeawn. A moderate amount of forbs and shrubs are also present such as broom snakeweed, threeawn, catclaw, dalea, prickly pear, and saltbush. Vegetation is somewhat sparse except in areas receiving extra moisture from runoff. Soil depth limits density of plants. Large areas of bare ground or areas of severe gully erosion can exist. These soils are not a preferred site by livestock. Production is low and palatability of forage is less than on sites that have more suitable soils.

Under heavy grazing the more palatable grasses are reduced and bare ground increases. If cover is reduced, the danger of severe erosion increases. If the climax grasses and forbs are removed from this site, it will revert to broom snakeweed, prickly pear, annuals, and mesquite.

Sandy Loam ecological site. The Redona soils in map unit RfC are in this ecological site.

The composition, by weight, is about 83 percent grasses, 8 percent forbs, 2 percent cryptogams, and 7 percent shrubs.

The natural plant community is a mixture of short and midgrasses with a smaller tallgrass complement. Midgrasses tend to dominate over most of the site with sideoats grama being the dominant midgrass. Little bluestem is the dominant tallgrass species. Small areas occur within the site where blue grama is dominant. Forbs make up 5 percent or less of total production. Shrubs are few with yucca, catclaw, and sand sage occurring in amounts of 5 percent or less.

Under heavy grazing, the tall and midgrasses decline and the shorter grasses increase. If abuse is prolonged the site will revert to a shortgrass dominated site. Blue grama acts as a strong increaser under heavy grazing. Further degradation will allow an invasion of threeawns and annuals. Sand sagebrush and yucca will generally increase.

Sandy Plains ecological site. Berwolf and Ima soils in map units BfB and IMC are in this ecological site.

The composition, by weight, is about 65 percent grasses, 10 percent forbs, and 25 percent shrubs.

This is a tallgrass climax. Nearly half of the grass component is composed of tallgrasses such as little bluestem and sand bluestem along with taller dropseed species. The remaining grass vegetation is mid and shortgrasses such as sideoats grama, sand dropseed, hooded windmillgrass, sand lovegrass, sand paspalum, fall witchgrass, hairy grama, needle and thread, and perennial threeawn. Forbs make up from 8 to 12 percent of the total herbaceous vegetation. Woody shrubs, namely sand sage, shinoak, and skunkbush, make up 20 to 25 percent of the plant community.

Under heavy grazing the tallgrass species decline with brush and midgrasses filling the void. With further abuse, weedy species such as western ragweed, camphorweed, sagewort, and annuals make up more than half of the yearly production. Sometimes the sand sagebrush, shinoak, and skunkbush can increase to form more than a 50 percent canopy.

Shale Sandstone ecological site. Lacoca soils in map unit IMC are in this ecological site.

The composition, by weight, is about 80 percent grasses, 12 percent forbs, 2 percent cryptogams, and 6 percent shrubs.

The natural plant community is a mixture of midgrasses with a few tallgrass species present. A moderate amount of forbs and shrubs are also present. Vegetation is sparse and consists of sideoats grama, little bluestem, hairy grama, and perennial threeawn.

Some woody shrubs such as catclaw, dalea, juniper, and hackberry occur along with numerous forbs. Soil depth limits plant density. Large areas of layered shelf-rock sandstone and bare rocky ground are common. This is not a preferred site by livestock. Production is low and palatability of forage is less than on sites with more favorable soils. Wildlife use on the site is infrequent because of sparse cover.

Under heavy grazing the more palatable grasses are reduced and bare ground increases. If cover is reduced, the danger of erosion increases. If the climax grasses and forbs are removed from this site, it will revert to broom snakeweed, threeawns, and annuals.

Very Shallow ecological site. Kimberson and Potter soils in map units KmB, MVE, PGE, and PMG are in this ecological site (fig. 29). The composition, by weight, is about 80 percent grasses, 10 percent forbs, 2 percent cryptogams, and 8 percent shrubs.

The natural plant community is a mixture of short and midgrasses with a few tallgrass species. A moderate amount of forbs and shrubs are also present. Major grass species are sideoats grama, little bluestem, hairy grama, blue grama, slim tridens, and sand dropseed. The major forbs include black samson, dotted gayfeather, catclaw sensitivebriar, plains actinea, and annual forbs. Yucca, catclaw, feather dalea, and broom snakeweed are the major woody species along with ephedra and skunkbush. Vegetation is somewhat sparse except in higher moisture areas. Soil depth limits plant density. Large areas of bare ground are common. The calcareous nature of the soil further narrows the species occupying the site. This is not a preferred site by livestock. Production is low and palatability of forage is less than on sites with more favorable soils.

Under heavy grazing the more palatable grasses are reduced and bare ground increases. If cover is reduced, the danger of erosion increases. If the climax grasses and forbs are removed from this site it will revert to broom snakeweed, threeawns, and annuals.

Figure 29.—Typical area of the Very Shallow ecological site on the Kimberson soil in the Kimberson gravelly loam, 0 to 3 percent slopes, map unit.

Windbreaks and Environmental Plantings

Charles Coffman, Wildlife Biologist, Natural Resources Conservation Service, Lubbock, Texas, prepared this section.

Windbreaks protect livestock, buildings, roads, yards, fruit trees, gardens, and cropland from wind and snow; help to keep snow on fields; and provide food and cover for wildlife. 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. Living snow fences are plantings of mostly evergreen species that protect against drifting snow on private and public roads. Livestock protection plantings are generally narrow evergreen plantings that are shaped to provide protection from harsh winter conditions.

Environmental plantings (farmstead windbreaks) help to beautify and screen houses and other buildings, abate noise, and reduce wind. 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.

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 or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 12 and table 13 according to limitations that affect their suitability for recreation. 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. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and 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 0.00 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 table 12 and table 13 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

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, Wildlife Biologist, Natural Resources Conservation Service, Lubbock, Texas, prepared 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 and manipulating the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 14 and table 15 the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. The degree and kind of soil suitability are given for grain and seed crop for food and cover; domestic grasses and legumes for food and cover; upland wild herbaceous plants; upland shrubs and vines; and freshwater wetland plants. 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 ratings use both descriptive and numerically ranked values. Rating class descriptive terms indicate how well the soils are suited according to the soil features. *Well suited* 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. *Suited* 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. *Poorly suited* 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.

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 elements of wildlife habitat are described in the following paragraphs.

Ratings for *grain and seed crops* for wildlife use as food and cover provide guidelines in the selection of sites that reflect soil properties and plant species necessary to sustain wildlife habitat and not to reflect commercial agronomic production. Soil properties and features that affect the growth of grain and seed crops are soil texture, organic mater content, the amount of rock fragments on or near the soil surface, available water capacity, depth to bedrock or pan, soil moisture and temperature regime, depth to high water table, soil moisture and temperature regime, ponding and flooding, permeability into the soil surface, slope, presence of excess salts, susceptibility of the soil surface to water and wind erosion. Examples of grain and seed crops are corn, wheat, oats, grain sorghum, and millet.

Ratings for *domestic grasses and legumes* for use as wildlife food and cover provide guidelines in the selection of sites that reflect soil properties and plant species necessary to sustain wildlife habitat and not to reflect commercial agronomic production. Soil properties and features that affect the growth of grasses and legumes are soil texture, organic mater content, the amount of rock fragments on or near the soil surface, available water capacity, depth to bedrock or pan, soil moisture and temperature regime, depth to high water table, soil moisture and temperature regime, ponding and flooding, permeability into the soil surface, slope, presence of excess salts, susceptibility of the soil surface to water and wind erosion. Examples of grasses and legumes are old world bluestem, lovegrass, kleingrass, clover, alfalfa, and Illinois bundleflower.

Ratings for *upland wild herbaceous plants* provide guidelines for determining soil quality as a medium for growing a diverse upland herbaceous plant community which is adapted to soil conditions that are drier than those common in the moist riparian and wetland zones but that are not s dry as in the upland desert areas. Soil properties and features that affect the ability of these species to thrive include soil texture, available water capacity, the presence of excess salts in the soil, soil moisture and temperature regimes, depth to high water table, the presence of rock fragments at the soil surface. Examples of upland wild herbaceous plants are little bluestem, switchgrass, western ragweed, croton and sideoats grama.

Ratings for *upland shrubs and vines* provide guidelines for determining soil quality as a medium for growing a diverse upland shrub and vine community which is adapted to soil conditions that are drier than those common in the moist riparian and wetland zones but that are not as dry as those in the upland desert area. Soil properties and features that affect the ability of these species to thrive include soil texture, soil organic matter, available water capacity, depth to bedrock or pan, the presence of excess salts in the soil, soil temperature and moisture regime, depth to high water table, and the presence of rock fragments at the soil surface. Examples of upland shrubs and vines are four-wing saltbush, shinnery oak, and flameleaf sumac.

Ratings for *freshwater wetland plants* provide guidelines for determining soil quality as a medium for growing plants which are adapted to wet soil conditions. The soils suitable for this habitat generally occur along marshes, depressions, bottom lands, backwater areas of flood plains, drainages adjacent to streams, springs and seeps or any other landscape position that are not directly affected by moving floodwaters but may have ponded water in some parts of the year. The soil properties and features that affect the ability of freshwater wetland plants to persist include soil texture, soil organic matter content, depth to high water table, ponding, the presence of excess salts in the soil, and soil reaction (pH). Examples of freshwater wetland plants are smartweed, saltgrass, bulrush, knotgrass, cattail, rushes, and sedges.

Hydric Soils

In this section, hydric soils are defined and described.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 1995). The criteria are used to identify a phase of a soil series that normally is also a hydric soil. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil

Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2003) and in the "Soil Survey Manual" (Soil Survey Staff, 1993).

If soils are wet enough for a long enough period to be considered hydric, they generally exhibit certain properties that can be observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils in this survey area are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and others, 1998).

For information regarding hydric soils in the soil survey area, refer to the USDA Natural Resources Conservation Service Soil Data Mart at http:www.usda.gov

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 estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil 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, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; 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 16 and table 17 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. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and 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 0.00 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 18 and table 19 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. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and 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 0.00 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 20 and table 21 give information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good, fair,* or *poor* as potential sources of topsoil, reclamation material, and roadfill. 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 topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

The soils are rated as a *probable* or *improbable* source of sand and gravel. A rating of *probable* means that the source material is likely to be in or below the soil. The numerical ratings in these columns indicate the degree of probability. The number 0.00 indicates that the soil is an improbable source. A number between 0.00 and 1.00 indicates the degree to which the soil is a probable source of sand or gravel.

Sand and *gravel* 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 20, only the probability 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 lowest layer of the soil contains sand or gravel, the soil is rated as a probable source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

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.

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).

Water Management

Table 22, table 23, and table 24 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; aquifer-fed excavated ponds; constructing grassed waterways and surface drains; constructing terraces and diversions; and tile drains and underground outlets. 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).

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.

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

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

Tile drains and underground outlets. Tile drains and underground outlets require installation of subterranean plumbing or other outlet devices that would allow proper drainage of excess water within the soil which might otherwise cause management problems, such as buildup of salts from evaporation or a shallow water table. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect installation of tile drains and underground outlets. A restricted rooting depth, toxic substances such as salts and sodium, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Soil interpretations for irrigation all application methods evaluate a soil's limitation(s) for irrigation practices. The ratings are for soils in their natural condition and do not consider present land use. The irrigation interpretations are not designed or intended to be used in a regulatory manner.

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 interpretations for sprinkler irrigation evaluate a soil's limitation(s) for sprinkler irrigation systems. The ratings are for soils in their natural condition and do not consider present land use. The irrigation interpretations are not designed or intended to be used in a regulatory manner.

Sprinkler irrigation systems apply irrigation water to a crop through a series of pipes and nozzles and can be either solid set or mobile. Generally, this type of irrigation system is suitable for small grains, row crops, vegetables, and orchards.

The soil properties and qualities important in the design and management of sprinkler irrigation systems are depth, available water holding capacity, sodium adsorption ratio, surface coarse fragments, air and water permeability, salinity, slope, wetness, and flooding. The features that affect performance of the system and plant growth are surface texture and rocks, salinity, sodium adsorption ratio, wetness, erosion potential, and available water holding capacity.

Soil interpretations for drip or trickle irrigation evaluate a soil's limitation(s) for surface drip irrigation of crops. This type of irrigation system applies water at a very slow rate near the plants. The ratings are for soils in their natural condition and do not consider present land use. The irrigation interpretations are not designed or intended to be used in a regulatory manner.

Drip or trickle irrigation systems are irrigation systems that supply water to the plant very slowly. Generally, drip irrigation systems are very efficient irrigation technologies in terms of both water and energy use and are suitable for use in some crops.

The soil properties and qualities important in the design and management of drip irrigation systems are depth, wetness, ponding, internal drainage, and flooding. The soil properties and qualities that influence installation are depth, flooding, and ponding. The features that affect performance of the system and plant growth are the amount of salts, lime, gypsum, or sodium.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained 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. These results are reported in table 33.

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 25 gives the engineering classifications and the range of index 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 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If 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, 1998) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1998).

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 in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, 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 in diameter 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. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 25.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an 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 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

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

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

Physical Soil Properties

Table 26 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.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In table 26, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In table 26, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In table 26, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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 millimeters in diameter. Bulk density data are used to compute 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 table 26, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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 table 26 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 several 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 millimeters 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 as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

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 27 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.

Effective cation-exchange capacity refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

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 millimeters 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 millimeters 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

Water Features Table 28 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 and very 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 to very 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.

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. Table 28 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. Table 28 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 29 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.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

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 physical analysis of several typical pedons in the survey area are given in table 30 and the results of chemical analysis in table 31. The results of clay mineralogy analysis are in table 32. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series. They are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska, and the Soil Characterization Laboratory, Texas Tech University, Lubbock, Texas.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. 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 published methods (USDA, 1996).

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all material less than 75 mm (3B1).

Coarse materials—(2-250 mm fraction) volume estimates of the percentages of all material greater than 2 mm (3B2).

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

Silt—(0.002-0.05 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).

Carbonate clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1d).

Water retained—pressure extraction, percentage of ovendry weight of less than 2 mm material; 1/3 or 1/10 bar (4B1), 15 bars (4B2).

Water-retention difference—between 1/3 bar and 15 bars for whole soil (4C1).

Bulk density—of less than 2 mm material, saran-coated clods field moist (4A1a), 1/3 bar (4A1d), ovendry (4A1h).

Moist bulk density—of less than 2 mm material, cores (4A3).

Moist bulk density—of less than 2 mm material, compliant cavity (4A5).

Linear extensibility—change in clod dimension based on whole soil (4D).

Organic carbon—wet combustion. Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c).

Organic carbon—dry combustion (6A2d).

Total nitrogen—Kjeldahl (6B3).
Extractable cations—ammonium acetate pH 7.0, ICP; calcium (6N2i), magnesium (6O2h), sodium (6P2f), potassium (6Q2f).
Extractable acidity—barium chloride-triethanolamine IV (6H5a).
Cation-exchange capacity—ammonium acetate, pH 7.0, steam distillation (5A8b).
Cation-exchange capacity—sum of cations (5A3a).
Effective cation-exchange capacity—sum of extractable cations plus aluminum (5A3b).
Base saturation—ammonium acetate, pH 7.0 (5C1).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1f).
Reaction (pH)—potassium chloride (8C1g).
Aluminum—acid oxalate extraction (6G12b).
Iron—acid oxalate extraction (6C9b).
Silica—acid oxalate extraction (6V2b).
Sesquioxides—dithionate-citrate extract; iron (6C2h), aluminum (6G7b), manganese (6D2g).
Soil resistivity—saturated paste (8E1).
Total soluble salts—estimate from conductivity (8D5).
Carbonate as calcium carbonate—(fraction less than 2 mm [80 mesh]) manometric (6E1h).
Gypsum—precipitation in acetone (6F1a).
Soluble ions—anion chromatograph, saturated paste; chloride (6K1f), sulfate (6L1f), nitrate (6M1f); fluoride (6U1d); nitrite (6W1d).
Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).
Extractable phosphorus—Bray P-1 (6S3).

Engineering Index Test Data

Table 33 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.

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

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). 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 34 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 Inceptisol.

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 Aquept (*Aqua*, meaning water, plus *ept*, from Inceptisol).

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 Halaquepts (*Hal*, meaning salty, plus *aquept*, the suborder of the Inceptisols that has an aquic 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 Halaquepts.

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 class, mineralogy class, cation-exchange activity class, reaction class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, siliceous, active, calcareous, hyperthermic Typic Halaquepts.

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. The “survey area” as defined is part of a Major Land Resource Area (MLRA). Major Land Resource Areas are geographically associated land resource units. The dominant physical characteristics of an MLRA are land use, elevation and topography, climate, water, soils, and potential natural vegetation. The boundaries of Deaf Smith County lie within three MLRAs. These include the Southern High Plains, Southern Part (MLRA-77C); Southern High Plains, Breaks (MLRA-77E); and Pecos-Canadian Plains and Valleys (MLRA-70B).

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 for the series in the MLRA survey area, is described. Most of the typifying pedons described below are not exclusively located within the boundaries of Deaf Smith County but are typical pedons for the series in the MLRA survey area of which Deaf Smith is a part. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1999) and in "Keys to Soil Taxonomy" (USDA, 1998). 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. It should be noted that a few of the typical pedons described below have a different surface layer texture phase than what is described in some of the map units for Deaf Smith County. Although the map unit surface texture phase may be different from that of the typical pedon of the series, it falls within the range of characteristics for the series. All soil interpretations in the Deaf Smith County soil survey are based on the surface texture phase of the map unit for the county.

Berda Series

The Berda series consists of very deep, well drained, moderately permeable soils that formed in loamy alluvial and colluvial sediments from the Ogallala Formation of Miocene-Pliocene age (fig. 30). These soils are on very gently sloping valley flats or gently sloping to very steep valley sides or scarps. Slopes range from 1 to 50 percent. The soils are fine-loamy, mixed, superactive, thermic Aridic Haplustepts.

Typical pedon of Berda loam on a 3 percent slope; Floyd County, Texas; from the intersection U.S. Highway 62 and Farm Road 54 about 7 miles south of Floydada, 0.5 mile north on Highway 62, 0.8 mile east on county road, 0.8 mile north on county road, 0.7 mile southeast on private road into Blanco Canyon, about 0.6 mile east on ranch road, on the east side at the base of Indian Mound. Floydada, Texas USGS quad; Latitude 33 degrees, 52 minutes, 29.2 seconds N. and Longitude 101 degrees, 19 minutes, 51.4 seconds W., NAD 83.

A—0 to 7 inches; light brown (7.5YR 6/3) loam, brown (7.5YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; many very fine roots; common very fine and fine tubular pores; few fine fragments of indurated calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 10 inches thick)

Bw—7 to 22 inches; light brown (7.5YR 6/3) loam, brown (7.5YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine roots; common very fine and fine tubular pores; few fine threads of calcium carbonate in pore linings; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 20 inches thick)

Bk1—22 to 36 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm; common fine roots; common very fine and fine tubular pores; common fine threads and concretions of calcium carbonate, about 3 percent; violently effervescent; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)

Bk2—36 to 52 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm; common fine roots; common fine tubular pores; common fine threads and concretions of calcium carbonate, about

3 percent; violently effervescent; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)

Bk3—52 to 80 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; few very fine roots; common fine tubular pores; common threads, films, and concretions of calcium carbonate, about 4 percent; violently effervescent; moderately alkaline. (10 to 40 inches thick)

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 65 degrees F
Depth to cambric horizon: 5 to 10 inches
Depth to secondary carbonates: 5 to 30 inches
Solum thickness: More than 80 inches
Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 5YR to 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4 (Note: Epipedons with moist value and chromas lower than 3.5 are less than 7 inches thick)
Texture: Loam, clay loam
Coarse fragments: 0 to 4 percent siliceous gravel mainly on the soil surface, 0 to 10 percent caliche fragments throughout the horizon
Effervescence: Strong to violent
Reaction: Neutral to moderately alkaline

Bw horizon

Hue: 5YR to 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: Loam, sandy clay loam, clay loam
Coarse fragments: 0 to 5 percent caliche fragments
Visible calcium carbonate: Less than 2 percent in the form of threads, films, and concretions
Effervescence: Violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 5YR to 10YR
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 3 to 6
Texture: Loam, sandy clay loam, clay loam
Coarse fragments: 0 to 10 percent caliche fragments
Calcium carbonate equivalent: Less than 15 percent.
Visible calcium carbonate: 2 to 4 percent as threads, films, and concretions
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: Reworked loamy alluvial and colluvial sediments from the Ogallala Formation of Miocene-Pliocene age
Landform: Lower backslope and footslope positions on escarpments along eastern margins of the Southern High Plains and similar hillslope positions both within salina basins and along drainageways from the Canadian River southward
Slope: Dominantly 3 to 8 percent, but ranges from 0 to 50 percent
Mean annual air temperature: 55 to 63 degrees F
Mean annual precipitation: 16 to 24 inches
Frost-free period: 180 to 225 days
Elevation: 1,800 to 4,500 feet
Thornthwaite annual P-E index values: 24 to 33
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Very low on 1 to 3 percent slopes, low on 3 to 5 percent slopes, medium on 5 to 20 percent slopes, and high on 20 to 50 percent slopes

Figure 30.—Profile of Berda loam, 5 to 8 percent slopes, showing few calcium carbonate nodules and concretions throughout the soil profile.

Berwolf Series

The Berwolf series consists of very deep, well drained, moderately rapidly permeable soils derived from sandy sediments (primarily) from weathered sedimentary rocks (red beds) of Triassic age. These nearly level and gently sloping soils are on hillslopes, plains, and high terraces. Slopes range from 0 to 5 percent. The soils are coarse-loamy, mixed, superactive, thermic Ustic Calciargids.

Typical pedon of Berwolf fine sandy loam on a 1 percent slope; De Baca County, New Mexico; From the intersection of U.S. Highway 84 and New Mexico Highway 252 in Taiban, about 6 miles north on New Mexico Highway 252, 1 mile west, then 0.25 mile northwest on south side of road, sec. 19, T.4 N., R. 28 E. in rangeland, Candy Mesa, New Mexico USGS quad; Latitude 34 degrees, 33 minutes, 12 seconds N. and Longitude 104 degrees, 02 minutes, 38 seconds W., NAD 27.

A—0 to 11 inches; brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly alkaline; clear smooth boundary. (5 to 12 inches thick)

Bt1—11 to 20 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; common very fine and fine and few medium roots; common distinct clay films on ped faces; moderately alkaline; clear wavy boundary.

Bt2—20 to 34 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine and fine roots; many distinct clay films on ped faces; slightly effervescent; moderately alkaline; clear wavy boundary. (13 to 35 inches; combined thickness of Bt horizons.)

BCk1—34 to 45 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine and fine roots; common fine masses and few medium nodules of calcium carbonate; violently effervescent; moderately alkaline; abrupt wavy boundary. (8 to 17 inches thick)

BCk2—45 to 80 inches; pink (5YR 8/3) fine sandy loam, reddish yellow (5YR 7/6) moist; weak fine and medium subangular blocky structure; very hard, friable, slightly sticky and nonplastic; many large masses and nodules of calcium carbonate; violently effervescent; moderately alkaline.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in all parts for 205 days to 270 days, cumulative, in normal years.
Mean annual soil temperature: 59 to 62 degrees F
Depth to secondary carbonates: 20 to 40 inches
Depth to calcic horizon: 30 to 60 inches
Solum thickness: 60 to 80 inches
Particle-size control section: Less than 18 percent silicate clay

A horizon

Hue: 5YR or 7.5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 2 or 6
Texture: Loamy fine sand, fine sandy loam
Effervescence: None
Reaction: Neutral to moderately alkaline

Bt horizon

Hue: 2.5YR to 7.5YR
Value: 3 to 6 dry, 3 to 5 moist
Chroma: 2 to 8
Texture: Fine sandy loam, sandy loam
Particle size control section: 10 to 18 percent silicate clay; greater than 52 percent sand
Effervescence: None to slight
Reaction: Moderately alkaline

BCk horizon

Hue: 2.5YR to 7.5YR
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 2 to 8
Texture: Loamy fine sand, fine sandy loam, loam
Calcium carbonate equivalent: Greater than 15 percent
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Sandy sediments from weathered sandstones and shales (red beds) of Triassic age. Variable amounts of reworked alluvium from the Ogallala Formation of Miocene-Pliocene age may be incorporated in this clastic parent material.
Landform: Plains, hillslopes, and high terraces on an undulating landscape
Slope: 0 to 5 percent
Mean annual air temperature: 57 to 60 degrees F
Mean annual precipitation: 12 to 16 inches
Frost-free period: 180 to 200 days
Elevation: 3,700 to 5,300 feet
Thornthwaite annual P-E index values: 24 to 31
Drainage: Well drained
Permeability: Moderately rapid permeability
Surface runoff: Negligible on 0 to 1 percent slopes and very low on 1 to 3 percent slopes

Bippus Series

The Bippus series consists of very deep, well drained, moderately permeable soils that formed in reworked loamy alluvial sediments of Holocene age. These soils are on nearly level or very gently sloping flood plains or draws. Slopes range from 0 to 2 percent. The soils are fine-loamy, mixed, superactive, thermic Cumulic Haplustolls.

Typical pedon of Bippus clay loam on a 1 percent slope; Floyd County, Texas; from the intersection of U.S. Highway 70 and Farm Road 784 in Floydada; 10 miles west on Farm Road 784; 4.4 miles north on County Road 55 to the intersection; 200 feet north and 100 feet west into field. Plainview SE, Texas USGS quad; Latitude 34 degrees, 03 minutes, 37.6 seconds N. and Longitude 101 degrees, 30 minutes, 32.2 seconds W., NAD 27.

Ap1—0 to 8 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium granular and subangular blocky structure; slightly hard, very friable; moderately alkaline; gradual smooth boundary.

Ap2—8 to 14 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; common fine tubular pores; moderately alkaline; gradual smooth boundary. (combined thickness of the A horizons is 12 to 30 inches)

Bw1—14 to 26 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; common fine tubular pores; moderately alkaline; gradual smooth boundary. (8 to 28 inches thick)

Bw2—26 to 49 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; common fine tubular pores; moderately alkaline; gradual smooth boundary. (8 to 28 inches thick)

Bw3—49 to 65 inches; strong brown (7.5YR 4/6) sandy clay loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine tubular pores; few films, threads, and concretions of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary. (10 to 20 inches thick)

Bk—65 to 80 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; common fine tubular pores; calcium carbonate in the form of threads, masses, and concretions make up about 10 percent by volume; violently effervescent; moderately alkaline; clear smooth boundary.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 59 to 66 degrees F
Depth to secondary carbonates: 40 to 80 inches
Solum thickness: More than 80 inches
Particle-size control section: 20 to 35 percent silicate clay

Ap horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: Loam, clay loam, sandy clay loam
Effervescence: None to slight
Reaction: Neutral to moderately alkaline

Upper Bw horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: Clay loam, sandy clay loam, loam
Effervescence: None to slight
Reaction: Moderately alkaline

Lower Bw horizon

Hue: 5YR to 10YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 2 to 4
Texture: Clay loam, sandy clay loam, loam
Effervescence: None to slight
Reaction: Moderately alkaline

Bk horizon

Hue: 5YR or 10YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 3 to 6
Texture: Fine sandy loam, sandy clay loam, loam, clay loam
Secondary carbonates: 3 to 15 percent by volume
Effervescence: Strong or violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: Reworked loamy alluvial sediments derived from the Blackwater Draw of Pleistocene age and the Ogallala Formation of Miocene-Pliocene age
Landform: Flood plains within (generally) northwest to southeast trending draws that dissect the Southern High Plains
Slope: 0 to 2 percent
Mean annual air temperature: 57 to 64 degrees F
Mean annual precipitation: 16 to 24 inches
Frost-free period: 180 to 220
Elevation: 1,800 to 4,200 feet
Thornthwaite annual P-E index values: 30 to 34
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes and very low on 1 to 2 percent slopes

Drake Series

The Drake series consists of very deep, well drained, moderately permeable soils that develop on linear or curvilinear dunes on the eastern margin of playa basins on the Southern High Plains (fig. 31). These soils formed in calcareous, loamy eolian sediments of Late Pleistocene to Holocene age. Slopes range from 1 to 30 percent. The soils are fine-loamy, mixed, superactive, thermic Aridic Calciustepts.

Typical pedon of Drake loam on a 5 percent slope; Hockley County, Texas; From the junction of TX 300 and U.S. Highway 385 in Levelland, 1.6 miles south on U.S. Highway 385, 1.4 miles east on a county road, 0.4 mile north on county road, 100 feet east in a pasture. Levelland East, Texas USGS quad; Latitude 33 degrees, 32 minutes, 58.8 seconds and N. Longitude 102 degrees, 21 minutes, 00.3 seconds W., NAD 83.

A1—0 to 5 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable; common very fine and fine roots; few fine tubular pores; few wormcasts; strongly effervescent (9 percent calcium carbonate equivalent); moderately alkaline; clear smooth boundary.

A2—5 to 15 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable; common very fine and fine roots; few fine tubular pores; few wormcasts; few fine calcium carbonate nodules; strongly effervescent (9 percent calcium carbonate equivalent); moderately alkaline; gradual smooth boundary. (combined A horizons are 5 to 20 inches thick)

Bk1—15 to 28 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; common fine and medium roots; common fine and medium tubular pores; about 2 percent fine threads and nodules of calcium carbonate; violently effervescent (15 percent calcium carbonate equivalent); moderately alkaline; gradual smooth boundary. (5 to 20 inches thick)

Bk2—28 to 43 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; few fine and medium roots; common fine and medium tubular pores; about 2 percent fine threads and nodules of calcium carbonate; violently effervescent (19 percent calcium carbonate equivalent); moderately alkaline. (5 to 20 inches thick)

Bk3—43 to 69 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; few very fine and fine roots; few fine tubular pores; about 2 percent fine threads and nodules of calcium carbonate; violently effervescent (15 percent calcium carbonate equivalent); moderately alkaline. (5 to 30 inches thick)

Bk4—69 to 90 inches; light yellowish brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, very friable; few very fine and fine roots; few fine tubular pores; about 2 percent fine nodules of calcium carbonate; violently effervescent (13 percent calcium carbonate equivalent); moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 59 to 66 degrees F

Depth to secondary calcium carbonate: 5 to 20 inches

Solum thickness: More than 80 inches

Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry, 4 to 6 moist

Chroma: 2 to 4

Texture: Loamy fine sand, fine sandy loam, loam, sandy clay loam, clay loam

Effervescence: Strong or violent

Reaction: Slightly alkaline or moderately alkaline

Bw horizon (where present)

Hue: 10YR to 5Y

Value: 5 to 7 dry, 4 to 6 moist

Chroma: 1 to 3

Texture: Loam, sandy clay loam, clay loam

Visible *secondary calcium carbonate:* Less than 2 percent in the form of fine threads and nodules

Calcium carbonate equivalent: 5 to 12 percent

Effervescence: Strong or violent

Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 10YR to 5Y

Value: 5 to 8 dry, 4 to 7 moist

Chroma: 1 to 3

Texture: Loam, sandy clay loam, clay loam, fine sandy loam
Visible *secondary calcium carbonate:* 2 to 5 percent
Calcium carbonate equivalent: 15 to 40 percent
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: calcareous, loamy eolian sediments of Late Pleistocene to Holocene age
Landform: Convex, linear, and curvilinear dunes on the eastern margin of playa basins or salinas
Slope: Dominantly 3 to 8 percent, but range from 1 to 30 percent
Mean annual air temperature: 57 to 64 degrees F
Mean annual precipitation: 15 to 20 inches
Frost-free period: 180 to 220 days
Elevation: 2,000 to 4,500 feet
Thornthwaite annual P-E index values: 22 to 33
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Medium on 1 to 8 percent slopes and high on 8 to 20 percent slopes

Figure 31.—Profile of Drake soils, 1 to 8 percent slopes, showing various layers of soil deposition and accumulations of secondary calcium carbonate throughout the soil profile.

Estacado Series

The Estacado series consists of very deep, well drained, moderately permeable soils that formed in calcareous loamy alluvial and eolian sediments of the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level and gently sloping plains. Slopes range from 0 to 5 percent. The soils are fine-loamy, mixed, superactive, thermic Aridic Paleustolls.

Typical pedon of Estacado clay loam, 0 to 1 percent slopes; Deaf Smith County, Texas; from the intersection of U.S. Highway 385 and U.S. Highway 60 in Hereford, 6.75 miles north on U.S. Highway 385, 3 miles east on county road, 0.5 mile north on county road, 600 feet east in cultivated field; Hereford NE, Texas USGS quad; Latitude 34 degrees, 25 minutes, 30 seconds N. and Longitude 102 degrees, 20 minutes, 10 seconds W., NAD 27.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; many fine roots; many fine and medium tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary. (5 to 10 inches thick)

Bt1—6 to 19 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, firm; many fine and medium roots between peds; many very fine and fine tubular pores; few distinct clay films on faces of peds; few fine masses of calcium carbonate; strongly effervescent; moderately alkaline; clear wavy boundary. (5 to 15 inches thick)

Bt2—19 to 38 inches; brown (7.5YR 4/4) clay loam, brown (7.5YR 3/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; common very fine and fine roots between peds; many very fine and fine tubular pores; few distinct clay films on ped surfaces; common fine nodules of calcium carbonate; strongly effervescent; moderately alkaline; gradual irregular boundary. (12 to 35 inches thick)

Btk1—38 to 50 inches; reddish yellow (7.5YR 7/6) clay loam, light brown (7.5YR 6/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; common very fine and fine roots between peds; many fine and medium tubular pores; few distinct clay films on ped surfaces; many masses and films of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary. (15 to 25 inches thick)

Btk2—50 to 80 inches; pinkish white (7.5YR 8/2) clay loam; pinkish gray (7.5YR 7/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; common very fine and fine roots between peds; many fine and medium tubular pores; few distinct clay films on ped surfaces; many masses and nodules of calcium carbonate; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 58 to 68 degrees F

Thickness of mollic epipedon: 10 to 25 inches

Depth to argillic horizon: 5 to 10 inches

Depth to secondary calcium carbonate: 5 to 24 inches

Depth to calcic horizon: 24 to 40 inches

Solum thickness: More than 80 inches

Particle-size control section: 20 to 35 percent silicate clay

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 or 3
Texture: Loam, clay loam
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Bt horizon

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: Sandy clay loam, clay loam
Visible calcium carbonate: Less than 2 percent as films or threads
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Btk horizon

Hue: 7.5YR or 10YR
Value: 4 to 8 dry, 3 to 7 moist
Chroma: 3 to 6 (Note: Matrix color is redder than 7.5YR and chroma is 5 or more)
Texture: Sandy clay loam, clay loam
Visible calcium carbonate: 2 to 50 percent as films, threads, masses, and concretions
Effervescence: Strong to violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Calcareous, loamy alluvial and eolian sediments of the Blackwater Draw Formation of Pleistocene age
Landform: On nearly level and gently sloping upland plains
Slope: 0 to 5 percent
Elevation: 2,000 to 4,000 feet
Mean annual air temperature: 56 to 66 degrees F
Mean annual precipitation: 16 to 22 inches
Frost-free period: 185 to 220 days
Thornthwaite annual P-E index values: 26 to 34
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes, very low on 1 to 3 percent slopes, and low on 3 to 5 percent slopes

Friona Series

The Friona series consists of well drained soils that are moderately deep to a petrocalcic horizon (fig. 32). Permeability of the soil above the petrocalcic horizon is moderate and permeability of the petrocalcic horizon is slow. These soils formed in loamy eolian sediments of Pleistocene age and are on nearly level to gently sloping plains. Slopes range from 0 to 3 percent. The soils are fine-loamy, mixed, superactive, thermic Petrocalcic Paleustolls.

Typical pedon of Friona loam on a 0.5 percent slope; Parmer County, Texas; About 3 miles west of Lazbuddie on County Road 145 and 3 miles south on County Road, 1,600 feet west and 1,000 feet south of the northeast corner sec. 38 Doud and Keefer Survey in cultivated field. Lazbuddie SW, Texas USGS quad; Latitude 34 degrees, 20 minutes, 30 seconds N. and Longitude 102 degrees, 40 minutes, 31 seconds W., NAD 27.

Ap—0 to 8 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly alkaline; abrupt smooth boundary. (5 to 12 inches)

Bt1—8 to 15 inches; brown (7.5YR 4/2), sandy clay loam; dark brown (7.5YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; many fine roots, many fine tubular pores; many wormcasts; common distinct clay films on prism faces; moderately alkaline; clear smooth boundary. (5 to 15 inches)

Bt2—15 to 26 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; hard, friable; many fine roots, many fine tubular pores; common wormcasts; common distinct clay films on ped surfaces; slightly effervescent; moderately alkaline; gradual wavy boundary. (0 to 15 inches.)

Btk—26 to 31 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common very fine roots, common fine tubular pores; common wormcasts; common distinct clay films on ped surfaces; about 5 percent calcium carbonate in the form of films, threads, concretions, and fine masses; strongly effervescent; moderately alkaline; abrupt wavy boundary. (0 to 10 inches thick)

Bkm—31 to 35 inches; pinkish white (7.5YR 8/2) caliche; indurated in upper part and strongly cemented in lower part; the upper surface is laminar and smooth; the lower part has pendants of calcium carbonate up to 1 cm. long; gradual wavy boundary. (4 to 24 inches thick)

B'tk1—35 to 59 inches; pinkish white (7.5YR 8/2) sandy clay loam, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; slightly hard, friable; common very fine and fine pores; few distinct clay films; about 50 percent calcium carbonate in the form of masses and concretions; violently effervescent; moderately alkaline; gradual wavy boundary. (10 to 30 inches thick)

B'tk2—59 to 80 inches; pink (5YR 7/4) sandy clay loam, reddish yellow (5YR 6/6) moist; hard, friable; common very fine and fine pores; few distinct clay films; about 20 percent calcium carbonate in the form of masses and concretions; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 58 to 65 degrees F
Thickness of mollic epipedon: 10 to 20 inches
Depth to secondary carbonates: 15 to 36 inches
Depth to petrocalcic horizon: 20 to 35 inches
Solum thickness: 20 to 40 inches
Particle-size control section: 20 to 35 percent silicate clay

A horizon

Hue: 5YR to 10YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 or 3
Texture: Loam, sandy loam
Effervescence: None
Reaction: Neutral to moderately alkaline

Bt horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6
Texture: Sandy clay loam, clay loam
Calcium carbonate equivalent: 0 to 10 percent
Visible calcium carbonate: Films and threads range from few to none
Effervescence: Slight to strong
Reaction: Neutral to moderately alkaline

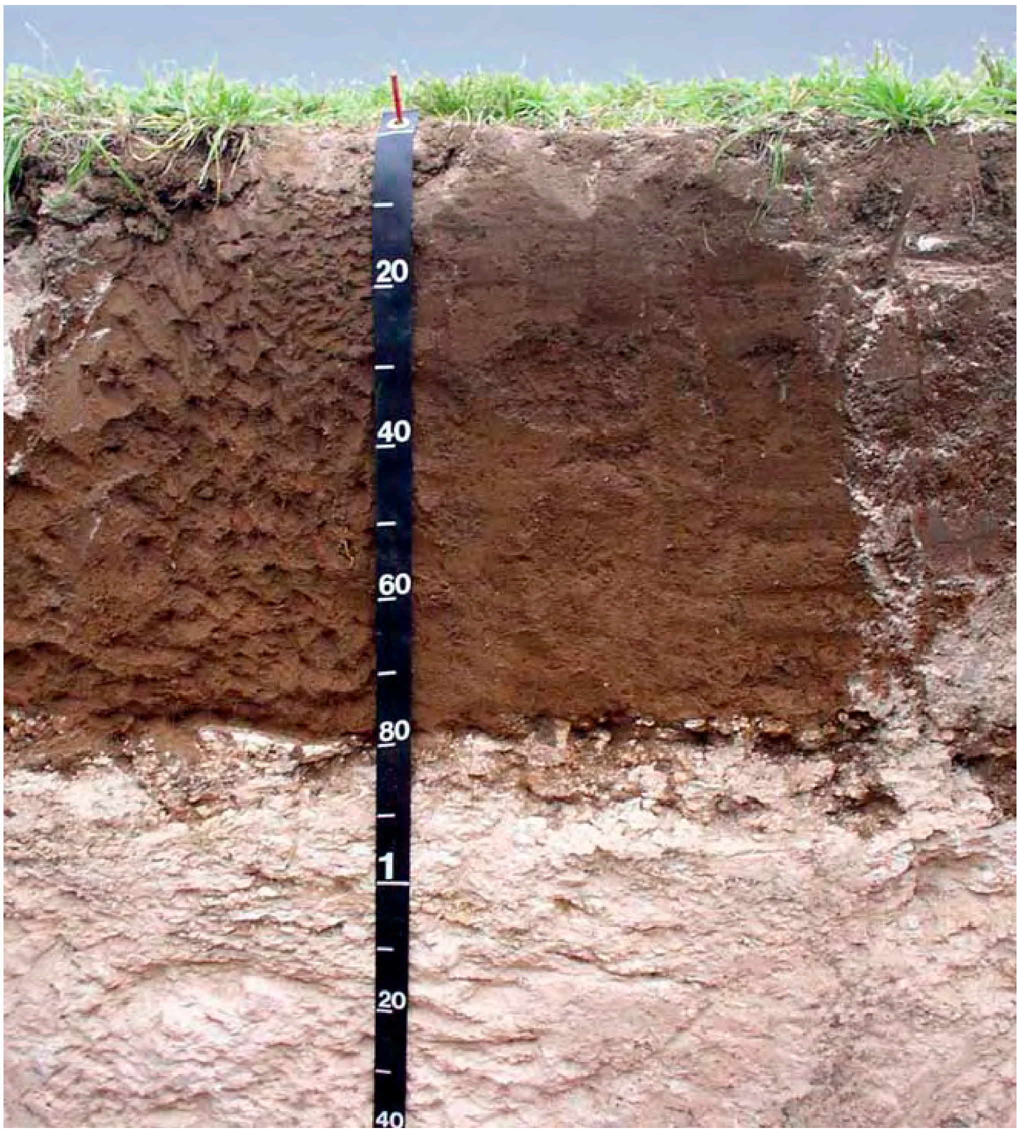

Figure 32.—Profile of Friona loam, 1 to 3 percent slopes, showing a petrocalcic horizon that has a laminar capped indurated layer over strongly cemented calcium carbonate in the lower part. Scale is in centimeters.

Btk horizon (where present)

Hue: 2.5YR to 7.5YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 3 to 6
Texture: Loam, sandy clay loam, clay loam
Calcium carbonate equivalent: 3 to 15 percent
Visible calcium carbonate: 3 to 10 percent in the form of films, threads, masses, and concretions
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bkm horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6
Thickness of petrocalcic horizon: 4 to 24 inches but ranges to several feet in some pedons and is indurated to strongly cemented

B'tk horizon or BCk horizon

Hue: 2.5YR to 7.5YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 3 to 6
Texture: Loam, sandy clay loam, clay loam
Calcium carbonate equivalent: 15 to 40 percent
Visible calcium carbonate: 10 to 60 percent by volume, ranging from thin soft coatings on macro structure to cemented vertical stringers, masses and concretions
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age
Landform: On nearly level and gently sloping plains
Slope: 1 to 3 percent
Mean annual air temperature: 56 to 63 degrees F
Mean annual precipitation: 15 to 20 inches
Frost-free period: 180 to 220 days
Elevation: 2,000 to 4,500 feet
Thornthwaite annual P-E index values: 26 to 34
Drainage: Well drained
Permeability: Moderate permeability above the petrocalcic horizon; slow permeability in the petrocalcic horizon
Surface runoff: Low on 0 to 1 percent slopes and medium on 1 to 3 percent slopes

Glenrio Series

The Glenrio series consists of shallow, well drained soils that formed in calcareous, clayey alluvium weathered from shales of Triassic and Permian age. Permeability of the soil above the bedrock is slow, and permeability of the bedrock is very slow. These soils are on very gently sloping to moderately steep side slopes, ridges, and divides. Slopes range from 1 to 15 percent. The soils are clayey, mixed, superactive, thermic, shallow Ustic Haplocambids.

Typical pedon of Glenrio clay on an 8 percent slope; Hartley County, Texas; Martha Houghton Road; from the intersection of U.S. Highway 54 and Farm Road 767; 9.3 miles east of Farm Road 767; 0.25 mile north of Farm Road 767 on paved road leading to ranch headquarters and 1.75 miles east in rangeland; Pedarosa Camp, Texas USGS quad; Latitude 41 degrees, 14 minutes, 30 seconds N. and Longitude 102 degrees, 44 minutes, 10 seconds W., NAD 27.

A—0 to 4 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, firm; slightly effervescent; moderately alkaline; gradual smooth boundary. (3 to 8 inches thick)

Bw—4 to 14 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, firm; strongly effervescent; moderately alkaline; gradual smooth boundary. (6 to 14 inches thick)

Cr—14 to 60 inches; red (2.5YR 5/6) shale; massive; violently effervescent.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 205 but less than 270 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 59 degrees F
Depth to paralithic contact: 10 to 20 inches
Depth to secondary calcium carbonate: 3 to 10 inches
Solum thickness: 10 to 20 inches
Particle-size control section: 35 to 60 percent silicate clay

A horizon

Hue: 2.5YR or 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 to 6
Texture: Clay loam, silty clay, clay
Visible calcium carbonate: Few films and threads
Coarse fragments: None to few siliceous gravel on the surface
Effervescence: Slightly or strongly
Reaction: Moderately alkaline

Bw horizon

Hue: 2.5YR or 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 to 6
Texture: Clay loam, silty clay, clay
Visible calcium carbonate: Few films and threads
Effervescence: Slightly or strongly
Reaction: Moderately alkaline

Cr horizon

Hue: 2.5YR or 5Y
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 1 to 8
Effervescence: Slight to violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Calcareous, clayey alluvium weathered from shales of Triassic or Permian age
Landform: Gently sloping to steeply sloping footslopes and low ridges and divides
Slope: 1 to 15 percent
Mean annual air temperature: 55 to 57 degrees
Mean annual precipitation: 15 to 20 inches
Frost-free period: 180 to 190 days
Elevation: 3,200 to 4,000 feet
Thornthwaite annual P-E index values: 25 to 34
Drainage: Well drained
Permeability: Slow permeability above the bedrock; very slow permeability of the bedrock
Surface runoff: High on less than 1 percent slopes and very high on 1 to 15 percent slopes

Ima Series

The Ima series consists of deep, well drained soils that formed in alluvium and eolian materials derived dominantly from sandstone and shale of the Jurassic, Triassic, and Permian ages. These soils are on hillslopes, plains, alluvial fans, terraces, and piedmonts. Slopes range from 0 to 10 percent. The soil is coarse-loamy, mixed, superactive, thermic Ustic Haplocambids.

Typical pedon of Ima sandy loam on a 2 percent slope; Quay County, New Mexico; 0.5 mile northeast of Tucumcari Memorial Park, then 2.6 miles north on county road, then 1,000 feet west on private road on south side of road, or 1,000 feet west and 120 feet south of the northeast corner, sec. 10, T. 11 N., R. 30 E; Latitude: 35 degrees, 12 minutes, 03 seconds N; Longitude: 103 degrees, 43 minutes, 25 seconds W; Tucumcari, New Mexico USGS quad; NAD 27.

A1—0 to 5 inches; reddish brown (5YR 5/3) sandy loam, reddish brown (5YR 4/3) moist; weak fine granular structure with a weak thin crust in the upper 1 to 2 inches; soft, very friable, nonsticky and nonplastic; common fine roots; common very fine and fine pores; slightly alkaline; clear smooth boundary. (2 to 6 inches thick)

A2—5 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; common very fine and fine pores; slightly alkaline; clear smooth boundary. (0 to 8 inches thick)

Bw—10 to 32 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few fine roots; few very fine and fine pores; few fine calcium carbonate accumulations in lower part; strongly effervescent; slightly alkaline; clear smooth boundary. (10 to 34 inches thick)

Bk—32 to 40 inches; light reddish brown (5YR 6/4) fine sandy loam, dark brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine pores; common fine and medium calcium carbonate masses; violently effervescent; moderately alkaline; abrupt smooth boundary. (10 to 40 inches thick)

C—40 to 80 inches; reddish yellow (5YR 7/6) very fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; violently effervescent; moderately alkaline.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in some or all parts for more than 205 but less than 270 days, cumulative, in normal years. October through May are the driest months. These soils are intermittently moist June through September.
Mean annual soil temperature: 59 to 62 degrees F
Depth to secondary carbonates: 20 to 30 inches
Solum thickness: Less than 80 inches
Particle-size control section: 10 to 18 percent silicate clay

A horizon

Hue: 5YR to 10 YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 or 4
Texture: Loamy fine sand, sandy loam, fine sandy loam
Coarse fragments: 0 to 5 percent siliceous gravel
Pararock fragments: 0 to 5 percent caliche gravel and few sandstone fragments
Effervescence: None to slight
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 3 to 6 moist
Texture: Loamy very fine sand, fine sandy loam, sandy loam, or loam
Clay content: 8 to 18 percent
Calcium carbonate equivalent: Less than 15 percent
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 3 to 6 moist
Texture: Loamy very fine sand, fine sandy loam, sandy loam, or loam
Visible calcium carbonate: 2 to 10 percent as masses, films, and threads
Calcium carbonate equivalent: Less than 15 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

C horizon

Hue: 5YR or 7.5YR
Value: 5 to 7 dry, 3 to 6 moist
Chroma: 4 to 6
Effervescence: Strong or violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Alluvium and eolian deposits mostly from Jurassic, Triassic, Permian, and Pennsylvanian sandstones and shales
Landform: Hillslopes, plains, alluvial fans, terraces, and piedmonts
Slope: 0 to 10 percent
Mean annual air temperature: 57 to 62 degrees F
Mean annual precipitation: 12 to 17 inches
Frost-free period: 180 to 210 days

Elevation: 4,000 to 4,600 feet
Thornthwaite annual P-E index values: 28 to32
Drainage: Well drained
Permeability: Moderately rapid permeability
Surface runoff: Negligible on 0 to 3 percent slopes, very low on 3 to 5 percent slopes, and low on 5 to 10 percent slopes

Kimberson Series

The Kimberson series consists of soils that are very shallow or shallow to a petrocalcic horizon (fig. 33). They are well drained, calcareous, gravelly and cobbly soils that formed in a thin mantle of loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age and an underlying indurated caliche of Pliocene age. These soils occur on gently sloping plains, mainly adjacent to escarpments, and on summit positions of knolls and interfluves. Slopes range from 0 to 3 percent. The soils are loamy, mixed, superactive, thermic, shallow Petrocalcic Calciustolls.

Typical pedon of Kimberson gravelly loam on a 1 percent slope; Hockley County, Texas; from the intersection of Farm Road 1490 and Farm Road 597 in Oklahoma Flat, 3.25 miles west on Farm Road 597; after entering gate north onto Yellowhouse Ranch, immediately west approximately 0.35 mile on ranch road; then northwest approximately 0.45 mile; Latitude: 33 degrees, 47.544 minutes N; Longitude: 102 degrees, 28.039 minutes W; Oklahoma Flat, Texas USGS quad; NAD 83.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; many very fine, fine, and medium roots; 10 percent gravel-sized and 5 percent cobble-sized indurated caliche fragments; strongly effervescent; finely disseminated calcium carbonate; moderately alkaline; clear wavy boundary. (2 to 5 inches thick)

A2—5 to 11 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine to medium subangular blocky; slightly hard, friable; many very fine, fine, and medium roots; 30 percent gravel-sized and 10 percent cobble-sized indurated caliche fragments; violently effervescent; finely disseminated calcium carbonate; moderately alkaline; abrupt wavy boundary. (2 to 15 inches thick)

Bkm—11 to 28 inches; white (10YR 8/1) indurated platy caliche containing a few fractures; laminar in the upper part; thin to thick, concentrically-banded pisolitic pattern below the laminar layer; common very fine, fine, and medium roots along fractures between indurated caliche plates; violently effervescent; moderately alkaline; gradual wavy boundary. (5 to 70 inches thick)

Bk—28 to 64 inches; white (10YR 8/1) and light gray (10YR 7/2) extremely cobbly sandy loam, white (10YR 8/1) and light brownish gray (10YR 6/2) moist; massive; very weakly cemented to moderately cemented; common very fine and fine roots; 40 percent gravel-sized and 45 percent cobble-sized indurated caliche fragments; violently effervescent; moderately alkaline; gradual wavy boundary. (0 to 36 inches thick)

B'km—64 to 80 inches; white (10YR 8/1) indurated platy indurated caliche containing a few fractures; laminar in the upper part; few very fine roots along fractures between indurated caliche plates; violently effervescent; moderately alkaline.

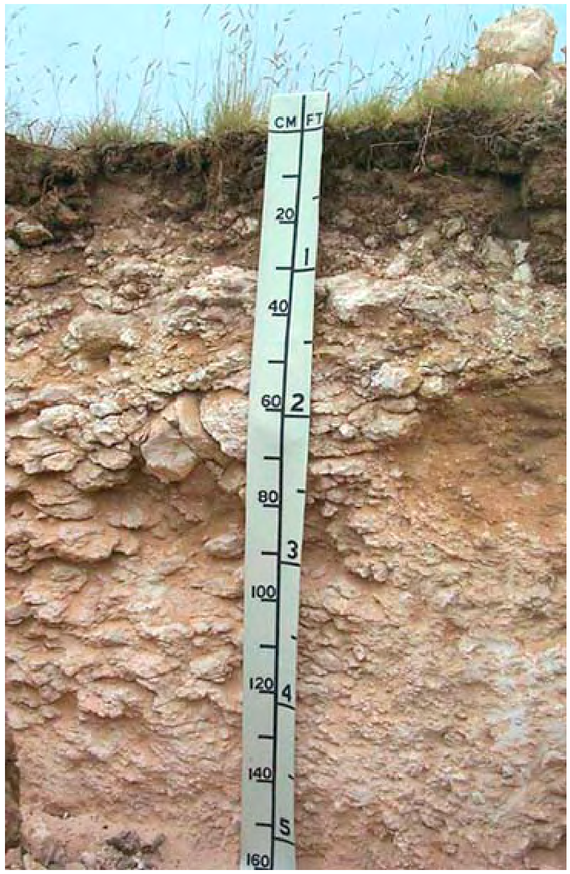

Figure 33.—Profile of Kimberson gravelly loam, 0 to 3 percent slopes, showing the dark gravelly surface horizon and indurated caliche layer below.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 270 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 59 to 67 degrees F
Thickness of mollic epipedon: 7 to 20 inches
Depth to petrocalcic horizon: 4 to 20 inches
Solum thickness: 4 to 20 inches
Particle-size control section: 18 to 35 percent silicate clay
Coarse fragments: 5 to 40 percent
CEC/clay ratio: Greater than 0.60

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: Fine sandy loam, loam, their gravelly counterparts, or very gravelly loam
Coarse fragments: 5 to 40 percent of indurated caliche fragments
Calcium carbonate equivalent: 0 to 30 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Visible calcium carbonate: 5 to 20 percent both finely disseminated and in the form of masses, nodules, or concretions

Bkm horizon

Hue: 7.5YR or 10YR
Value: 7 or 8 dry, 7 moist
Chroma: 1 to 3

(Note: This horizon ranges from indurated, fractured, with a thin to thick laminar zone in the upper part to continuously indurated with thin to thick, concentrically-banded pisolitic structure below the laminar layer.)

Bk horizon (not present in all pedons)

Hue: 7.5YR or 10YR
Value: 7 or 8 dry, 6 or 7 moist
Chroma: 1 to 4
Texture: Extremely gravelly sandy loam, extremely gravelly loam, extremely cobbly sandy loam, or extremely cobbly loam
Coarse fragments: Greater than 60 percent indurated caliche fragments with interstitial soil materials
Calcium carbonate equivalent: More than 40 percent
Effervescence: Violent
Reaction: Moderately alkaline

B'km horizon (not present in all pedons)

Hue: 7.5YR or 10YR
Value: 7 or 8 dry, 7 moist
Chroma: 1 to 3

(Note: This horizon ranges from indurated, fractured, with a thin to thick laminar zone in the upper part to being continuously indurated with a thin to thick, concentrically-banded pisolitic pattern below the laminar layer.)

Geographic setting

Parent material: A thin mantle of loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age and an underlying indurated caliche of Pliocene age
Landform: Nearly level and gently sloping plains, typically adjacent to escarpments, and summit positions on knolls and interfluves
Slope: 0 to 3 percent
Elevation: 2,800 to 3,800 feet
Mean annual air temperature: 55 to 61 degrees F
Mean annual soil temperature: 57 to 63 degrees F
Mean annual precipitation: 14 to 20 inches
Frost-free period: 190 to 220 days
Thornthwaite annual P-E index values: 28 to 34
Drainage: Well drained
Permeability: Moderate permeability above the petrocalcic horizon; very slow permeability in the petrocalcic horizon
Surface runoff: High on slopes less than 1 percent and very high on 1 to 3 percent slopes

Lacoca Series

The Lacoca series consists of very shallow and shallow, well drained, moderately permeable, calcareous, soils that formed in residuum and colluvium derived from strongly cemented sandstone bedrock of the Santa Rosa and Chinle Formation of Triassic age.

These nearly level to very steep soils are mainly on convex, low ridgetops and side slopes of erosional plains. Slopes range from 0 to 50 percent. The soils are loamy, mixed, superactive, calcareous, thermic Lithic Ustic Torriorthents.

Typical pedon of Lacoca fine sandy loam on a 3 percent slope; Guadalupe County, New Mexico; take the Santa Rosa Lake Road to Santa Rosa Lake, then 2 miles east on State Park road, then 1.5 miles northeast on east side of road or New Mexico Coordinate System, Eastern Zone, 1,474,340 feet north and 404,500 feet east in the Preston Beck Land Grant in rangeland. Catfish Falls, New Mexico USGS quad; Latitude 35 degrees, 03 minutes, 07 seconds W., Longitude 104 degrees, 39 minutes, 08 seconds N., NAD 27.

A—0 to 8 inches; light brown (7.5YR 5/4) fine sandy loam, brown(7.5YR 4/4) moist; weak medium and fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; common fine interstitial pores; 5 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary. (4 to 20 inches thick)

R—8 to 80 inches; sandstone bedrock, carbonate coated surface.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in all parts for 180 days to 270 days, cumulative, in normal years. The period of maximum precipitation is May through October.
Mean annual soil temperature: 59 to 62 degrees F
Solum thickness: 4 to 14 inches, but can range up to 20 inches in some pedons
Particle-size control section: 5 to 18 percent silicate clay

A horizon

Hue: 2.5YR to 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6
Texture: Loam, sandy loam, fine sandy loam, or loamy fine sand
Silicate *clay content:* 5 to 18 percent
Coarse fragments: Less than 15 percent of strongly cemented sandstone fragments
Surface fragments: 0 to 5 percent strongly cemented sandstone fragments
Effervescence: Strong to violent
Reaction: Moderately alkaline

R horizon

Hardness: 3 or 4 on the Mohs scale

Geographic setting

Parent material: Residuum weathered from strongly cemented sandstone of the Santa Rosa, Chinle, and Dockum Formation
Landform: Mainly on convex, low ridgetops, and side slopes of erosional plains
Slope: 0 to 50 percent
Mean annual air temperature: 58 to 64 degrees F
Mean annual precipitation: 12 to 16 inches
Frost-free period: 180 to 205 days
Elevation: 3,800 to 5,300 feet
Thornthwaite annual P-E index values: 22 to 28
Drainage: Well drained
Permeability: Moderately rapid permeability above a very slowly permeable rock contact
Surface runoff: High on less than 1 percent slopes and very high on slopes of 1 to 50 percent

Lazbuddie Series

The Lazbuddie series consists of very deep, moderately well drained, very slowly permeable soils that developed in calcareous, clayey lacustrine sediments derived from the Blackwater Draw Formation of Pleistocene age (fig. 34). These nearly level soils are on playa steps 2 to 10 feet above the floor in large playa basins and range from a few acres to more than 200 acres. Slopes are 0 to 1 percent. The soils are fine, smectitic, thermic Calcic Haplusterts.

Typical pedon of Lazbuddie clay on a 0.3 percent slope; Oldham County, Texas; From the intersection of Interstate 40 and U.S. Highway 385 in Vega; 1.6 miles south on U.S. Highway 385; 0.2 mile east on private road; 0.5 mile north on private road; 0.33 mile east into playa basin; Latitude: 35 degrees, 12 minutes, 29 seconds N; Longitude: 102 degrees, 22 minutes, 15 seconds W; Vega South, Texas USGS quad; NAD 1927.

Ap—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to moderate fine angular blocky; hard, firm; common fine and medium roots; common medium distinct dark gray (10YR 4/1) crack fill material; cracks 1 inch wide extend through the horizon; strongly effervescent; moderately alkaline; clear smooth boundary. (3 to 10 inches thick)

Bw—4 to 12 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine and medium roots; common fine and medium tubular pores; common medium distinct dark gray (10YR 4/1) crack fill material; few distinct pressure faces on ped surfaces; cracks 1 inch wide extend through the horizon; strongly effervescent; moderately alkaline; gradual wavy boundary. (0 to 14 inches thick)

Bss1—12 to 25 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; very hard, very firm; common fine and medium roots; common fine and medium tubular pores; common medium distinct dark grayish brown (10YR 4/2) crack fill material; few distinct intersecting slickensides on horizontal ped faces and many distinct slickensides; cracks 1 inch wide extend through the horizon; few fine distinct yellowish brown (10YR 5/4) masses of iron accumulation on ped surfaces; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bss2—25 to 35 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; very hard, very firm; common fine and medium roots; common fine and medium tubular pores; common medium distinct dark grayish brown (10YR 4/2) crack fill material; few distinct slickensides on horizontal ped faces and many distinct slickensides; cracks 0.5 inch wide extend through the horizon; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bss3—35 to 45 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; moderate coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; very hard, very firm; common very fine and fine roots; common very fine and fine tubular pores; few distinct slickensides on horizontal ped faces; cracks 0.5 inch wide extend through the horizon; few fine calcium carbonate nodules; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation on ped surfaces; common fine distinct grayish brown (10YR 5/2) iron depletions on ped surfaces; violently effervescent; moderately alkaline; gradual wavy boundary. (combined thickness of the Bss horizons is 20 to 40 inches)

Bkss1—45 to 53 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common very fine and fine roots; common very fine and fine tubular pores; few distinct slickensides on horizontal ped faces; fine films, threads, and nodules of calcium carbonate, about 10 percent; violently effervescent; common fine distinct yellowish brown (10YR 5/6) masses of iron accumulation on ped surfaces; common medium distinct grayish brown (10YR 5/2) iron depletions on ped surfaces; moderately alkaline; gradual wavy boundary. (10 to 30 inches thick)

Bkss2—53 to 69 inches; light gray (2.5Y 7/2) and pale yellow (2.5Y 8/2) clay, light brownish gray (2.5Y 6/2) and light gray (2.5Y 7/2) moist; common fine distinct yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; very hard, very firm; common fine roots between peds; common fine tubular pores; few distinct slickensides on horizontal ped faces; few light gray (10YR 7/1) silt coats on horizontal ped faces; fine threads, films, and nodules of calcium carbonate, about 15 percent; common prominent brownish yellow (10YR 6/6) masses of iron accumulation on ped faces and in pore linings; violently effervescent; moderately alkaline; clear wavy boundary. (5 to 20 inches thick)

Bkss3—69 to 80 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common very fine tubular pores; few distinct slickensides on horizontal ped faces; few light gray (10YR 7/1) silt coats on horizontal faces of peds; fine films, threads, and nodules of calcium carbonate, about 5 percent; common prominent brownish yellow (10YR 6/6) masses of iron accumulation in pore linings and few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation on ped surfaces; common medium distinct grayish brown (10YR 5/2) iron depletions on ped surfaces; violently effervescent; moderately alkaline; clear smooth boundary.

Soil moisture: An aridic ustic moisture regime bordering on typic ustic. The soil cracks and is dry in some or all parts of the upper 20 inches for more than 150 but less than 210 cumulative days in normal years. July through August and November through March are the driest months. These soils are intermittently moist in September through October and April through June. The soil receives runoff and is dry in the soil moisture control section for fewer days than the surrounding soils on uplands.

Mean annual soil temperature: 57 to 62 degrees F

Visible calcium carbonate: In Bw and Bss horizons, less than 2 percent by volume or the calcium carbonate equivalent of a given horizon is less than 5 percent or more (absolute) higher than that of an underlying horizon. The high range of calcium carbonate equivalent for these horizons is related to the calcareous lacustrine parent sediments.

Depth to secondary calcium carbonate: 5 to 40 inches

Depth to calcic horizon: 40 to 60 inches

Depth to slickensides: 3 to 22 inches

Solum thickness: More than 80 inches

Particle-size control section: 50 to 60 percent silicate clay

(Note: This is a cyclic soil and undisturbed areas have gilgai microrelief with microknolls 5 to 18 inches higher than microdepressions. Distance between the center of the microknoll and the center of the microdepression is about 5 to 20 feet. The microknoll makes up about 25 percent, the intermediate area between the knoll and depression about 50 percent, and the microdepression about 25 percent. Cracks open and close each year, except during higher than normal rainfall years, and remain open for 150 to 210 cumulative days during most years. If dry, 0.4 to 3 inch wide cracks extend from the surface to a depth of 40 inches or more. Cracks are more prominent in the microdepressions. COLE is greater than 0.07. The range in characteristics represents 50 percent or more of each pedon unless otherwise stated.)

A horizon

Hue: 10YR or 2.5Y
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 1 or 2; Epipedons with (moist) values and chroma less than 3.5 are less than 7 inches thick or have less than 0.6 percent organic-carbon content.
Texture: Silty clay, clay
Calcium carbonate equivalent: 5 to 30 percent
Visible calcium carbonate: 0 to 2 percent as films, threads, and nodules
Effervescence: Slight to violent
Reaction: Moderately alkaline

(Note: Thickness of the A horizon varies with microrelief, ranging from 3 to 10 inches)

Bw horizon (where present)

Hue: 10YR or 2.5Y
Value: 6 or 7 dry, 4 to 6 moist
Chroma: 1 or 2
Texture: Silty clay, clay
Calcium carbonate equivalent: 5 to 30 percent
Visible calcium carbonate: 0 to 2 percent as films, threads, and nodules
Effervescence: Slight to violent
Reaction: Moderately alkaline or strongly alkaline

Bss horizon

Hue: 10YR or 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 1 or 2
Texture: Silty clay, clay
Calcium carbonate equivalent: 5 to 30 percent
Visible calcium carbonate: 0 to 2 percent as films, threads, and nodules
Effervescence: Slight to violent
Reaction: Moderately alkaline or strongly alkaline

Bkss horizon

Hue: 10YR or 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 1 or 2
Texture: Silty clay, clay
Calcium carbonate equivalent: 15 to 40 percent
Visible calcium carbonate: 5 to 50 percent by volume in the form of threads, masses, and nodules
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Bk horizon (where present)

Hue: 10YR or 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 1 or 2
Redoximorphic concentrations: Masses of iron in pore linings or on horizontal ped faces range from none to common
Texture: Silty clay, clay
Calcium carbonate equivalent: 15 to 30 percent
Visible calcium carbonate: 5 to 40 percent by volume in the form of threads, masses, and nodules

Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: Calcareous, clayey lacustrine sediments derived from the Blackwater Draw Formation of Pleistocene age
Landform: Playa step 2 to 10 feet above the floor in large playa basins; range from a few acres to more than 200 acres
Slope: 0 to 1 percent
Mean annual air temperature: 55 to 60 degrees F
Mean annual precipitation: 15 to 21 inches

Figure 34.—Profile of Lazbuddie clay, 0 to 1 percent slopes, showing accumulations of secondary carbonates throughout the profile and a strong calcic horizon at about 54 inches. Scale is in centimeters.

Frost-free period: 180 to 210 days
Elevation: 3,000 to 4,800 feet
Thornthwaite annual P-E index values: 24 to 34
Drainage: Moderately well drained
Permeability: Permeability is very slow
Surface runoff: Negligible on 0 to 1 percent slopes. (Note: These soils pond for very brief to brief periods in some years)

Lofton Series

The Lofton series consists of very deep, moderately well drained, very slowly permeable soils that formed in clayey lacustrine sediments of the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level playa terraces, floors of shallow playa basins, or slight depressions on nearly level plains. Slopes are 0 to 1 percent. The soils are fine, mixed, superactive, thermic Vertic Argiustolls.

Typical pedon of Lofton clay loam on a 0.5 percent slope; Armstrong County, Texas; From the intersection of U.S. Highway 287 and Texas State Highway 207 in Claude, 1.5 miles south on Texas State Highway 207, 0.5 mile west on county road, and 100 feet north of road in cropland; Latitude: 35 degrees, 05 minutes, 30 seconds N; Longitude: 101 degrees, 22 minutes, 25 seconds W; Claude, Texas USGS quad; NAD 27.

Ap—0 to 9 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable; common fine roots; common fine pores; slightly alkaline; abrupt smooth boundary. (4 to 10 inches thick)

Bt1—9 to 24 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; extremely hard, firm; common many fine roots; many fine pores; common prominent clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Bt2—24 to 38 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; extremely hard, very firm; common fine roots; common fine pores; common prominent clay films on faces of peds; some peds are wedge-shaped tilted 10 degrees to 15 degrees from horizontal and have pressure faces; few films and threads of calcium carbonate in lower part; matrix is noneffervescent, moderately alkaline; gradual wavy boundary. (8 to 20 inches thick)

Btk—38 to 52 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; very hard, firm; few very fine roots; common distinct clay films on faces of peds; about 2 percent visible calcium carbonate in the form of threads and films; strongly effervescent; moderately alkaline; clear smooth boundary. (10 to 30 inches thick)

Bk—52 to 80 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; hard, friable; common distinct clay films on faces of peds; about 25 percent visible calcium carbonate in the form of threads, masses, and concretions; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime. The soil moisture control section is dry in some or all parts more than 180 but less than 205 cumulative days in normal years. July through August and November through March are the driest months. These soils are intermittently moist in September through October and April through June. The soil receives runoff from surrounding soils and the soil moisture control section is moist for longer periods than that of the surrounding soils.
Mean annual soil temperature: 59 to 64 degrees F
Depth to argillic horizon: 6 to 10 inches
Depth to secondary calcium carbonate: 20 to 40 inches
Depth to calcic horizon: 40 to 60 inches

Vertic properties: When dry, cracks 0.25 to 1 inch wide extend to depths of 20 inches or more. COLE ranges from 0.06 to 0.09 in the upper 40 inches.
Solum thickness: More than 80 inches
Particle-size control section: 35 to 50 percent silicate clay

Ap horizon

Hue: 10YR or 2.5Y
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 or 2
Texture: Clay loam, silty clay loam
Reaction: Neutral to moderately alkaline
Effervescence: None

Bt horizon

Hue: 10YR or 2.5Y
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 1 to 3
Texture: Clay, silty clay
Reaction: Slightly alkaline or moderately alkaline
Effervescence: None or slight

Btk horizon (where present)

Hue: 10YR or 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 1 to 6
Texture: Clay, silty clay, clay loam
Calcium carbonate equivalent: 5 to 30 percent
Visible calcium carbonate: 3 to 40 percent in the form of films, threads, masses, or nodules
Reaction: Moderately alkaline
Effervescence: Violent

Bk horizon (where present)

Hue: 10YR or 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 1 to 6
Texture: Silty clay, clay, clay loam
Calcium carbonate equivalent: 5 to 40 percent
Secondary calcium carbonate: 15 to 50 percent in the form of films, threads, masses, or concretions
Reaction: Moderately alkaline
Effervescence: Violent

Geographic setting

Parent material: Clayey lacustrine sediments of the Blackwater Draw Formation of Pleistocene age
Landform: Nearly level playa step, floor of shallow playa basins, or slight depressions on nearly level plains
Slope: 0 to 1 percent
Mean annual air temperature: 57 to 62 degrees F
Mean annual precipitation: 16 to 23 inches.
Frost-free period: 185 to 215 days
Elevation: 2,200 to 4,500 feet
Thornthwaite annual P-E index values: 25 to 34

Drainage: Moderately well drained
Permeability: Very slow permeability
Surface runoff: Negligible on less than one percent slopes (Note: These soils may occasionally pond for very brief periods.)

McLean Series

The McLean series consists of very deep, somewhat poorly drained, very slowly permeable soils that developed in clayey lacustrine sediments of Pleistocene age. These nearly level soils are on the floor of playa basins 5 to 75 feet below the surrounding plain and range from a few acres to more than 200 acres. Slopes are 0 to 1 percent. The soils are fine, smectitic, thermic Udic Haplusterts.

Typical pedon of McLean clay on a 0.3 percent slope; Carson County, Texas; From the intersection of State Highway 207 and U.S. Highway 60 in Panhandle; 4.7 miles southwest on U.S. Highway 207; 2.25 miles south on county road; 1 mile south-southeast on turnrow; 0.5 mile into playa basin; Latitude: 35 degrees, 17 minutes, 25 seconds N; Longitude: 101 degrees, 27 minutes, 15 seconds W. Panhandle West, Texas USGS quad; NAD 27.

A1—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; hard, firm; very sticky and very plastic; common fine to coarse roots; cracks 2 inches wide at the surface extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; clear smooth boundary.

A2—4 to 7 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; very hard, very firm; very sticky and very plastic; common fine to coarse roots; common fine to coarse pores; cracks 2 inches wide extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; clear smooth boundary. (combined thickness of the A horizons is 5 to 15 inches)

Bss1—7 to 15 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common fine to coarse roots; common fine to coarse pores; common prominent slickensides; cracks 1 inch wide extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; few very fine calcium carbonate nodules; slightly alkaline; gradual wavy boundary.

Bss2—15 to 21 inches; dark gray (10YR 4/1) clay; very dark gray (10YR 3/1) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common fine to coarse roots; common fine to coarse pores; common prominent slickensides; cracks 1 inch wide extend through the horizon; few very fine calcium carbonate nodules; few fine distinct brown (7.5YR 4/4) masses of iron accumulation in pore linings; moderately alkaline; gradual wavy boundary.

Bss3—21 to 37 inches; dark gray (10YR 4/1) clay; very dark gray (10YR 3/1) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common fine and medium roots; common fine to coarse pores; common prominent slickensides; cracks 0.5 inch wide extend through the horizon; few very fine calcium carbonate nodules; few fine distinct brown (7.5YR 4/4) masses of iron accumulation in pore linings; moderately alkaline; gradual wavy boundary.

Bss4—37 to 42 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common fine and very fine roots; common very fine and fine pores; common prominent slickensides; cracks 0.5 inch wide extend to a depth of 40 inches; few very fine calcium carbonate nodules; few fine distinct reddish brown (5YR 4/4) masses of iron accumulation in pore linings; moderately alkaline; gradual wavy boundary.

Bss5—42 to 59 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common fine and very fine roots; common very fine to fine pores; common prominent slickensides; few threads and fine nodules of calcium carbonate, about 1 percent; common fine and medium distinct reddish brown (5YR 5/4) masses of iron accumulation in pore linings; slightly effervescent; moderately alkaline; clear wavy boundary. (combined thickness of the Bss horizons is 30 to 60 inches)

Bkss1—59 to 72 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; extremely hard, extremely firm; very sticky and very plastic; common very fine and fine roots; common very fine and fine pores; common prominent slickensides; about 3 percent fine masses and nodules of calcium carbonate; common fine distinct reddish brown (5YR 5/4) masses of iron accumulation in pore linings; slightly effervescent; moderately alkaline; clear wavy boundary.

Bkss2—72 to 80 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium and coarse wedge-shaped aggregates parting to strong fine and medium angular blocky structure; very hard, very firm; very sticky and very plastic; few very fine roots; common very fine and fine pores; common prominent slickensides; about 4 percent fine masses and nodules of calcium carbonate; common fine and medium distinct reddish brown (5YR 5/4) masses of iron accumulation in pore linings; strongly effervescent; moderately alkaline; gradual wavy boundary. (combined thickness of the Bkss horizons is 5 to 30 inches)

2Bk—80 to 88 inches; light reddish brown (5YR 6/4) clay, reddish brown (5YR 5/4) moist; moderate fine and medium angular blocky structure; very hard, very firm; very sticky and very plastic; few very fine and fine roots; few very fine and fine pores; about 8 percent fine and medium masses and nodules of calcium carbonate; common medium distinct dark grayish brown (10YR 4/2) iron depletions on ped surfaces; strongly effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on udic. The soil moisture control section is dry in some or all parts more than 90 but less than 150 cumulative days in normal years. July through August and November through March are the driest months. Intermittently moist in September through October and April through June. These soils receive runoff from surrounding uplands and the soil moisture control section is moist for longer periods of time than is normal for the climate.
Mean annual soil temperature: 57 to 62 degrees F
Depth to secondary calcium carbonate: 10 to more than 60 inches
Depth to slickensides: 5 to 15 inches
Solum thickness: More than 80 inches
Particle-size control section: 50 to 60 percent silicate clay

(Note: This is a cyclic soil and undisturbed areas have gilgai microrelief with microknolls 4 to 18 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 area between the knoll and depression, about 50 percent, and the microdepression about 25 percent. Cracks open and close each year except during higher than normal rainfall years, and remain open for less than 150 cumulative days during most years. If dry, 0.4 to 3 inch wide cracks extend from the surface to a depth of 40 inches or more. Cracks are more prominent in the microdepressions. COLE greater than 0.07. Where redoximorphic features exceed 3 percent, they occur in less than 25 percent of each pedon. The range in characteristics represents 50 percent or more of each pedon unless otherwise stated.)

A horizon

Hue: 7.5YR or 10YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 or 2
Redoximorphic features: None or few
Texture: Clay
Effervescence: None to strong
Reaction: Slightly acid to moderately alkaline

Bw horizon (where present)

Hue: 10YR or 2.5Y
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 or 2
Redoximorphic features: None or few
Texture: Clay
Effervescence: None to strong
Reaction: Neutral to moderately alkaline

Bss horizon

Hue: 10YR or 2.5Y
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 1 or 2
Redoximorphic features: Few to common
Texture: Clay
Visible calcium carbonate: Ranges from 0 to 2 percent by volume in the form of films, threads, and nodules
Effervescence: None to strong
Reaction: Neutral to moderately alkaline

Bkss horizon

Hue: 10YR or 2.5Y
Value: 4 to 8 dry, 3 to 7 moist
Chroma: 1 or 2
Redoximorphic features: None to common
Texture: Clay
Calcium carbonate equivalent: Less than 15 percent
Visible calcium carbonate: 3 to 10 percent as threads, masses, and nodules
Effervescence: Strong or violent
Reaction: Moderately alkaline

2Bk or 2Bt horizon (where present)

Hue: 5YR to 5Y
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 1 or 2

Redoximorphic features: None to common
Texture: Clay, silty clay
Calcium carbonate equivalent: Less than 15 percent
Visible calcium carbonate: 3 to 10 percent as threads, masses, and nodules
Effervescence: Strong or violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Clayey lacustrine sediments derived from Blackwater Draw Formation of Pleistocene age
Landform: In playas, 5 to 75 feet below the surrounding plain and range from a few acres to more than 200 acres
Slope: 0 to 1 percent
Mean annual air temperature: 55 to 60 degrees F
Mean annual precipitation: 15 to 21 inches
Frost-free period: 180 to 210 days
Elevation: 3,000 to 4,750 feet
Thornthwaite annual P-E index values: 24 to 34
Drainage: Somewhat poorly drained
Permeability: Very slow permeability
Surface runoff: Negligible (Note: These soils occasionally pond for brief to long periods.)

Minneosa Series

The Minneosa series consists of very deep, well drained soils that formed in sandy alluvial sediments. Permeability is moderately rapid. These soils are on low terraces and flood plains. Slopes range from 0 to 5 percent. The soils are sandy, mixed, thermic Ustic Torrifluvents.

Typical pedon of Minneosa loamy fine sand on a 1 percent slope; Quay County, New Mexico; 100 feet west and 100 feet south of the NE corner of sec. 1, T. 9N., R. 34E.

A—0 to 10 inches; light brown (7.5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) moist; single grained; loose, few very fine to medium roots; finely disseminated calcium carbonate; strongly effervescent; slightly alkaline; clear wavy boundary. (8 to 16 inches thick)

C—10 to 44 inches; very pale brown (10YR 7/4) loamy sand, brown (7.5YR 5/4) moist; single grained; loose, few very fine and fine roots; strata 1/2 to 2 inches thick of sandy loam and fine sandy loam occur irregularly throughout this horizon and are commonly slightly darker than the intervening material; finely disseminated calcium carbonate; strongly effervescent; slightly alkaline; abrupt smooth boundary. (30 to 55 or more inches thick)

2C—44 to 80 inches; reddish brown (5YR 5/3) silt loam, reddish brown (5YR 4/3) moist; massive with weak evidence of laminae; slightly hard, friable, slightly sticky, common medium faint pink (5YR 7/4) masses of iron accumulation; few very fine calcium carbonate nodules; violently effervescent; moderately alkaline.

Mean annual soil temperature: 60 to 62 degrees F

A horizon

Hue: 5YR or 7.5YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: Very fine sandy loam or loamy fine sand
Reaction: Slightly alkaline or moderately alkaline to a depth of 40 inches, and is calcareous throughout

C horizon (The 2C horizon is absent in some pedons)

Hue: 5YR to 10YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 5
Texture: Loamy sand with thin strata of sandy loam or fine sandy loam 0.25 inch to 2 inches thick
Reaction: Slightly alkaline or moderately alkaline to a depth of 40 inches, and is calcareous throughout

Geographic setting

Parent material: sandy alluvial sediments
Landform: low terraces and floodplains
Slope: dominantly less than 2 percent but range to 5 percent
Mean annual air temperature: 58 to 60 degrees F
Mean annual precipitation: 12 to 15 inches
Frost-free period: 180 to 200 days
Elevation: 4,200 to 5,300 feet
Thornthwaite annual P-E index values: 24 to 31
Drainage: Well drained
Permeability: Permeability is moderately rapid
Surface runoff: Negligible on slopes less than 3 percent and very low on 3 to 5 percent slopes

Mobeetie Series

The Mobeetie series consists of very deep, well drained, moderately rapidly permeable soils that formed in calcareous, sandy alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age. These soils are on nearly level to gently sloping valley flats or gently sloping to steep valley sides or scarps. Slopes range from 0 to 45 percent. The soils are coarse-loamy, mixed, superactive, thermic Aridic Haplustepts.

Typical pedon of Mobeetie fine sandy loam on a 4 percent slope; Lubbock County, Texas; 6.7 miles south of Acuff, Texas, on the Slaton Road in a pasture, 100 feet east of road. Location is 0.15 mile southeast of entrance to Wallace Ranch headquarters; Latitude: 33 degrees, 30 minutes, 15 seconds N; Longitude: 101 degrees, 37 minutes, 30 seconds W. Acuff, Texas USGS quad; NAD 27.

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; slightly sticky; common very fine and fine pores; few calcium carbonate nodules; few siliceous gravel; strongly effervescent; moderately alkaline; gradual smooth boundary. (6 to 18 inches thick)

Bw—10 to 26 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky and granular; slightly hard, very friable; many very fine to medium pores; few films and threads of calcium carbonate on faces of peds; few fine and medium calcium carbonate nodules; few siliceous gravel; violently effervescent; moderately alkaline; diffuse wavy boundary. (4 to 26 inches thick)

Bk—26 to 42 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky and granular; slightly hard, friable; many very fine to medium pores; few fine films and threads of calcium carbonate on surfaces of peds and few fine and medium calcium carbonate nodules, about 4 percent; few siliceous gravel; violently effervescent; moderately alkaline; diffuse boundary. (8 to 55 inches thick)

BC—42 to 80 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, friable; many fine to medium pores; few films and threads of calcium carbonate on faces of peds and few fine and medium calcium carbonate nodules; few siliceous gravel; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 67 degrees F
Depth to cambric horizon: 6 to 18 inches
Depth to secondary carbonates: 15 to 30 inches
Solum thickness: 40 to 60 inches
Particle-size control section: 10 to 18 percent silicate clay

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist (Note: Moist color value or chroma is more than 3.5 when the A horizon is more than 10 inches thick)
Chroma: 2 to 4
Texture: Fine sandy loam, loam
Coarse fragments: 0 to 12 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 5YR to 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam, loam
Coarse fragments: 0 to 10 percent
Visible calcium carbonate: Few films, threads, and nodules
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 5YR to 10YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 2 to 4
Texture: Fine sandy loam, loam
Coarse fragments: 0 to 10 percent
Visible calcium carbonate: 2 to 4 percent as films, threads, and nodules with maximum size of 2 to 3 inches across are present in most pedons
Calcium carbonate equivalent: Less than 15 percent
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

BC horizon

Hue: 5YR to 10YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 2 to 4
Texture: Fine sandy loam, loam
Coarse fragments: 0 to 10 percent

Visible calcium carbonate: 0 to 4 percent as films and threads
Calcium carbonate equivalent: Less than 15 percent
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting:

Parent material: Reworked, calcareous, loamy alluvial and colluvial sediments derived from the Ogallala Formation of Miocene-Pliocene age
Landform: Footslopes and alluvial fans below the receding, caliche-capped eastern margins of the Southern High Plains and similar hillslope positions along drainageways from the Canadian River southward
Slope: Dominantly 1 to 15 percent, but ranges from 0 to 40 percent
Mean annual air temperature: 55 to 65 degrees F
Mean annual precipitation: 15 to 22 inches
Frost-free period: 180 to 215 days
Elevation: 2,250 to 5,400 feet
Thornthwaite annual P-E index values: 28 to 34
Drainage: Well drained
Permeability: Moderately rapid permeability
Surface runoff: Negligible on 1 to 3 percent slopes, very low on 3 to 5 percent slopes, and low on 5 to 20 percent slopes

Olton Series

The Olton series consists of very deep, well drained, moderately slowly permeable soils that formed in loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level and gently sloping plains and upper side slopes of playas and draws. Slopes range from 0 to 5 percent. The soils are fine, mixed, superactive, thermic Aridic Paleustolls.

Typical pedon of Olton clay loam on a 2 percent slope; Randall County, Texas; from the intersection of U.S. Highway 87 and U.S. Highway 60 in Canyon, 5.5 miles west on U.S. Highway 60, 1.5 miles north on county road, then 0.6 mile east and 0.4 mile north in cultivated field or 2,800 feet east and 1,600 feet north of SE corner of sec. 7, Block 1. T. T. R. R. Survey. Latitude: 35 degrees, 01 minutes, 28 seconds N; Longitude: 102 degrees, 01 minutes, 03 seconds W. Bivins Lake, Texas USGS quad; NAD 27.

Ap—0 to 8 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular and subangular blocky structure; hard, friable; many fine roots; common fine pores; common earthworm channels; common wormcasts; neutral; gradual smooth boundary. (6 to 14 inches thick)

Bt1—8 to 15 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; few fine pores and root channels; few distinct clay films on faces of peds; slightly alkaline; gradual wavy boundary. (4 to 10 inches thick)

Bt2—15 to 31 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium angular blocky structure; very hard, firm; few fine roots, mostly between peds; earthworm channels and casts; few distinct clay films on faces of peds; noneffervescent in upper part; few films and threads of calcium carbonate at about 22 inches depth, slightly effervescent; moderately alkaline; gradual wavy boundary. (8 to 16 inches thick)

Btk1—31 to 48 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak medium angular blocky structure; very hard, firm; common fine root channels and pores; few distinct clay films on faces of peds; about 5 percent fine films and threads of calcium carbonate; violently effervescent; moderately alkaline; clear wavy boundary. (15 to 26 inches thick)

Btk2—48 to 75 inches; pink (5YR 7/3) clay loam, light reddish brown (5YR 6/4) moist; weak medium angular blocky and subangular blocky structure; hard, firm; few distinct clay films on faces of peds; about 35 percent fine and medium calcium carbonate masses and medium and coarse calcium carbonate nodules; violently effervescent; moderately alkaline; diffuse wavy boundary. (10 to 36 inches thick)

Btk3—75 to 80 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak very coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few distinct clay films on faces of peds and clay bridged sand grains; common films of calcium carbonate decreases with depth and are less than 2 percent in lower part; ped surfaces are strongly effervescent, some interiors of peds are noneffervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 59 to 68 degrees F
Depth to argillic horizon: 6 to 14 inches
Depth to secondary carbonates: 14 to 28 inches
Depth to calcic horizon: 30 to 60 inches
Solum thickness: Greater than 80 inches
Particle-size control section: 35 to 50 percent silicate clay

A horizon

Hue: 5YR to 10YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 or 3
Texture: Loam, clay loam
Effervescence: None to slight
Reaction: Neutral to moderately alkaline

Bt horizon

Hue: 5YR or 7.5YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 to 6
Texture: Clay loam, clay
Visible calcium carbonate: Few films and threads at about 22 inches
Effervescence: None to slight
Reaction: Slightly alkaline or moderately alkaline

Btk horizon

Hue: 2.5 to 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 3 to 8
Texture: Clay loam, silty clay loam
Visible calcium carbonate: 5 to 60 percent as masses, films, threads, concretions, and nodules.
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

B't horizon below the calcic (where present)

Hue: 2.5YR to 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 3 to 8

Texture: Loam, sandy clay loam, clay loam
Visible calcium carbonate: Few threads and films
Effervescence: Slight or strong
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: Loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age
Landform: Nearly level and gently sloping plains and upper side slopes of playas and draws
Slope: Dominantly less than 3 percent, but can range up to 5 percent
Mean annual air temperature: 57 to 66 degrees F
Mean annual precipitation: 17 to 22 inches
Frost-free period: 185 to 220 days
Elevation: 2,200 to 4,500 feet
Thornthwaite annual P-E index values: 26 to 34
Drainage: Well drained
Permeability: Moderately slow permeability
Surface runoff: Low on 0 to 1 percent slopes and medium on 1 to 5 percent slopes

Pantex Series

The Pantex series consists of very deep, well drained, slowly permeable soils that developed in clayey eolian sediments derived from the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level to very gently sloping level plains. Slopes are 0 to 1 percent. The soils are fine, mixed, superactive, thermic Torrertic Paleustolls.

Typical pedon of Pantex silty clay loam on a 0.3 percent slope; Carson County, Texas; 1.1 miles northeast of Panhandle on U.S. Highway 60 from its intersection with Texas Highway 15, 800 feet north of U.S. Highway 60 in cropland; Latitude: 35 degrees, 21 minutes, 30 seconds N; Longitude: 101 degrees, 22 minutes, 20 seconds W. Panhandle East, Texas USGS quad; NAD 27.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine roots; common very fine and fine pores; slightly alkaline; clear smooth boundary. (5 to 10 inches thick)

Bt1—7 to 20 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong medium angular blocky structure; few wedge-shaped peds with long axes tilted 10 to 15 degrees from horizontal; very hard, very firm; few fine roots; common fine pores; few pressure faces; common distinct clay films on ped surfaces; moderately alkaline; gradual smooth boundary. (6 to 20 inches thick)

Bt2—20 to 34 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; strong medium angular blocky structure; common wedge-shaped peds with long axes tilted 10 to 15 degrees from horizontal; very hard, very firm; few very fine roots; common fine pores; few pressure faces; common distinct clay films; moderately alkaline; gradual smooth boundary. (8 to 18 inches thick)

Bt3—34 to 49 inches; brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) moist; strong medium angular blocky structure; very hard, very firm; few fine roots; common very fine and fine pores; common distinct clay films; few threads of calcium carbonate in pores; strongly effervescent; moderately alkaline; gradual smooth boundary. (8 to 20 inches thick)

Bt4—49 to 60 inches; brown (7.5YR 4/4) silty clay loam, dark brown (7.5YR 3/4) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; common very fine and fine pores; common distinct clay films; few films and threads of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)

Bt5—60 to 71 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; strong medium angular blocky structure; very hard, very firm; few fine roots; common very fine and fine pores; common distinct clay films; few threads of calcium carbonate in pores; slightly effervescent; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)

Btk—71 to 80 inches; reddish yellow (5YR 7/6) silty clay loam, reddish yellow (5YR 6/6) moist; moderate medium subangular blocky structure; very hard, firm; common very fine pores; few distinct clay films; about 50 percent visible calcium carbonate in the form of masses, films, and threads; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 64 degrees F
Depth to argillic horizon: 5 to 10 inches
Depth to secondary calcium carbonate: 33 to 45 inches
Depth to calcic horizon: 60 to 80 inches
Solum thickness: More than 80 inches
Particle-size control section: 35 to 55 percent silicate clay

Ap horizon

Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 or 3
Texture: Silty clay loam
Effervescence: None
Reaction: Neutral or slightly alkaline

Bt horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 to 6
Texture: Silty clay, silty clay loam, clay
Calcium carbonate equivalent: 0 to 3 percent in the lower part of horizon
Effervescence: Very slight to slight
Reaction: Slightly alkaline or moderately alkaline

Btk horizon

Hue: 5YR or 7.5YR
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 2 to 6
Texture: Silty clay loam, silty clay, clay loam
Calcium carbonate equivalent: 20 to 60 percent as masses and concretions
Effervescence: Strong to violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Fine, clayey eolian sediments derived from Blackwater Draw Formation of Pleistocene age

Landform: Plane to slightly convex broad plains
Slope: Dominantly 0.2 to 0.8 percent, but ranges to 1 percent
Mean annual air temperature: 55 to 62 degrees F
Mean annual precipitation: 16 to 22 inches
Frost-free period: 180 to 210 days
Elevation: 2,500 to 4,500 feet
Thornthwaite annual P-E index values: 30 to 34
Drainage: Well drained
Permeability: Slow permeability
Surface runoff: Medium on 0 to 1 percent slopes

Pep Series

The Pep series consists of very deep, well drained, moderately permeable soils formed in calcareous, loamy eolian sediments of the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level and gently sloping plains and side slopes above playas and along draws. Slopes range from 0 to 5 percent. These soils are fine-loamy, mixed, superactive, thermic Aridic Calciustolls.

Typical pedon of Pep clay loam, 0 to 1 percent slopes; Deaf Smith County, Texas; From the intersection of U.S. Highway 385 and Farm Road 1058 in Hereford, 19.0 miles north on U.S. Highway 385 to Farm Road 2587, 6.0 miles west on Farm Road 2587, 4.5 miles north and 0.4 mile east on unpaved county roads, 200 feet south in cultivated field; Longitude: 35 degrees, 09 minutes, 57 seconds, N; Latitude: 102 degrees, 29 minutes, 30 seconds, W. Vega South, Texas USGS quad; NAD 27.

Ap—0 to 10 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; common fine roots, many very fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary. (5 to 14 inches thick)

Bw1—10 to 16 inches; yellowish red (5YR 5/6) clay loam, reddish brown (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine roots; common very fine pores; few threads and films of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary. (5 to 17 inches thick)

Bw2—16 to 32 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; few very fine pores; few threads and films of calcium carbonate; violently effervescent; moderately alkaline; gradual irregular boundary. (0 to 19 inches thick)

Bk—32 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; moderate medium subangular blocky structure; slightly hard, friable; common very fine and fine irregular pores; about 50 percent by volume calcium carbonate as threads, films, masses, and concretions; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 59 to 66 degrees F
Depth to cambric horizon: 5 to 14 inches
Depth to secondary calcium carbonate: 5 to 20 inches
Depth to calcic horizon: 20 to 40 inches
Solum thickness: More than 80 inches

Particle-size control section: 18 to 35 percent silicate clay

Ap horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 to 4
Texture: Loam, clay loam
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 5YR or 7.5YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 2 to 6
Texture: Loam, clay loam, silty clay loam
Visible calcium carbonate: 1 to 2 percent finely disseminated and as threads, films, and very fine and fine concretions
Calcium carbonate equivalent: 2 to 15 percent
Effervescence: Strong to violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 5YR or 7.5YR
Value: 6 to 8 dry, 5 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, silty clay loam
Visible calcium carbonate: 15 to 60 percent finely disseminated and as threads, films, masses, and fine and medium concretions.
Calcium carbonate equivalent: 15 to 50 percent.
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Calcareous, loamy eolian sediments derived from Blackwater Draw Formation of Pleistocene age
Landform: On nearly level and gently sloping plains and side slopes above playas and along draws with plane to convex surfaces
Slope: 0 to 5 percent
Mean annual air temperature: 57 to 64 degrees F
Mean annual precipitation: 16 to 22 inches
Frost-free period: 180 to 210 days
Elevation: 2,500 to 4,800 feet
Thornthwaite annual P-E index values: 22 to 32
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes, very low on 1 to 3 percent slopes, and low on 3 to 5 percent slopes

Plemons Series

The Plemons series consists of very deep, well drained, moderately permeable soils that formed in calcareous, loamy sediments derived from the upper part of the Ogallala Formation of Miocene-Pliocene age. These soils are on gently sloping to strongly sloping valley sides, draws, or broad erosion remnants. Slopes range from 1 to 12 percent. The soils are fine-loamy, mixed, superactive, thermic Calcidic Paleustalfs.

Typical pedon of Plemons loam on a 4 percent slope; Potter County, Texas; 0.5 mile north of the intersection of State Highway 136 and Farm Road 293 on State Highway 136, 0.1 mile west-northwest in rangeland; Latitude: 35 degrees, 21 minutes, 40 seconds N; Longitude: 101 degrees, 38 minutes, 32.4 seconds W. Mayer, Texas USGS quad; NAD 27.

A—0 to 6 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; many very fine and fine roots; few wormcasts; violently effervescent; moderately alkaline; clear smooth boundary. (4 to 7 inches thick)

Btk1—6 to 13 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, firm; many very fine and fine roots; common fine tubular pores; common wormcasts; few faint clay films on ped surfaces; few films and threads of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary. (5 to 15 inches thick)

Btk2—13 to 24 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common very fine and fine roots; common fine tubular pores; few faint clay films on ped surfaces; many threads and masses of calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 15 inches thick)

Btk3—24 to 35 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; common fine tubular pores; common distinct clay films on ped surfaces and in pores; common threads and masses of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary. (5 to 15 inches thick)

Btk4—35 to 46 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common very fine and fine roots; common fine tubular pores; common distinct clay films on ped surfaces and in pores; common threads and masses of calcium carbonate; few fine black (10YR 2/1) masses of oxide accumulation on ped surfaces; violently effervescent; strongly alkaline; gradual smooth boundary. (5 to 15 inches thick)

Btk5—46 to 58 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; common fine tubular pores; common distinct clay films on ped surfaces and in pores; common threads and masses of calcium carbonate; common fine black (10YR 2/1) masses of oxide accumulation on ped surfaces; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 15 inches thick)

Btk6—58 to 76 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; common fine tubular pores; common distinct clay films on ped surfaces and in pores; common threads and masses of calcium carbonate; common fine black (10YR 2/1) masses of oxide accumulation on ped surfaces; strongly effervescent; moderately alkaline; clear smooth boundary. (10 to 18 inches thick)

Btkb—76 to 80 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; few very fine roots; few fine tubular pores; common distinct clay films on ped surfaces and in pores; few films and threads of calcium carbonate; many fine black (10YR 2/1) masses of oxide accumulation on ped surfaces; strongly effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 63 degrees F
Depth to secondary carbonates: 7 to 24 inches
Depth to calcic horizon: 10 to 30 inches
Solum thickness: More than 80 inches
Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 5YR to10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: Loam
Calcium carbonate equivalent: 0 to 15 percent
Effervescence: Strong to violent
Reaction: Moderately alkaline

Bw horizon (where present)

Hue: 5YR to 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 4 to 6
Texture: Loam, sandy clay loam, clay loam
Visible secondary carbonates: 2 percent or less as films or threads
Calcium carbonate equivalent: 0 to 15 percent
Effervescence: Strong to violent
Reaction: Moderately alkaline

Btk horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 4 to 6
Texture: Sandy clay loam, clay loam
Visible secondary carbonates: 10 to 40 percent by volume as films, threads, masses, and concretions
Calcium carbonate equivalent: 5 to 40 percent (zone of maximum accumulation is between 10 and 30 inches)
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Btkb horizon (where present)

Hue: 5YR or 7.5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 4 to 6
Texture: Clay loam, clay
Visible secondary carbonates: 3 to 10 percent as films or threads
Calcium carbonate equivalent: 0 to 15 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Redoximorphic features: Fine masses or coatings of iron-oxide accumulation on ped surfaces range from few to many.

Geographic setting

Parent material: Calcareous, loamy sediments derived from the upper part of the Ogallala Formation of Miocene-Pliocene age
Landform: Very gently sloping to strongly sloping plains, upper backslopes of playas and drainageways
Slope: 1 to 8 percent but range to 12 percent
Mean annual air temperature: 55 to 61 degrees F
Mean annual precipitation: 17 to 21 inches
Frost-free period: 190 to 220 days
Elevation: 2,300 to 3,800 feet
Thornthwaite annual P-E index values: 30 to 34
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Very low on 1 to 3 percent slopes, low on 3 to 5 percent slopes, and medium on 5 to 12 percent slopes

Portales Series

The Portales series consists of very deep, well drained, moderately permeable soils. These soils formed in calcareous, loamy eolian and lacustrine sediments of Pleistocene age. These soils are on nearly level and very gently sloping concave plains associated with playa lake basins. Slopes range from 0 to 2 percent. The soils are fine-loamy, mixed, superactive, thermic Aridic Calciustolls.

Typical pedon of Portales loam on a 0.5 percent slope; Quay County, New Mexico; 2 miles east of McAlister on New Mexico Highway 312, north 2 miles on county road, east 1 mile on private road, 0.5 mile south on private road, 0.25 mile east to windmill, then east-southeast to southeast bench of playa or 1,500 feet north and 800 feet west of the SE corner of Sec 25, T. 6 N. R. 30 E.; Latitude: 34 degrees, 42 minutes, 42 seconds N; Longitude: 103 degrees, 42 minutes, 27 seconds, W. Weber City, New Mexico USGS quad; NAD 27.

A—0 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; soft, very friable, slightly sticky and slightly plastic; many fine roots, common fine pores; few fine masses of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary. (5 to 16 inches thick)

Bw—15 to 35 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine pores; few fine masses and disseminated calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary. (10 to 25 inches thick)

Bk1—35 to 43 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; soft, very friable, slightly sticky and slightly plastic; common fine masses and disseminated calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 20 inches thick)

Bk2—43 to 60 inches; white (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine masses of calcium carbonate; violently effervescent; moderately alkaline. (15 to 60 inches thick)

Bk3—60 to 80 inches; white (10YR 8/2) clay loam, light brownish gray (10YR 7/2) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine masses of calcium carbonate; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 59 to 66 degrees F
Depth to calcic horizon: 20 to 40 inches
Solum thickness: More than 80 inches
Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: Fine sandy loam, loam, clay loam
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bw horizon

Hue: 10YR
Value: 3 to 5 dry, 4 or 5 moist
Chroma: 3 to 6
Texture: Loam, clay loam
Calcium carbonate equivalent: 2 to 15 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bk horizon

Hue: 7.5YR to 2.5Y
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 2 to 5
Texture: Loam, clay loam
Calcium carbonate equivalent: 10 to 60 percent
Visible secondary carbonates: 5 to 10 percent
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Calcareous, loamy eolian and lacustrine sediments derived from the Blackwater Draw Formation of Pleistocene age
Landform: On slightly concave plains associated with playa lake basins, slightly convex playa terraces, slightly concave playas and footslopes and toeslopes of playa side slopes
Slope: Dominantly 0 to 1 percent, but ranges to 2 percent
Mean annual air temperature: 57 to 64 degrees F
Mean annual precipitation: 16 to 20 inches
Elevation: 2,700 to 4,800 feet
Frost-free period: 180 to 205 days
Thornthwaite annual P-E index values: 22 to 32
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes and very low on 1 to 3 percent slopes

Potter Series

The Potter series consists of very deep, well drained, moderately slowly permeable soils that formed in calcareous sediments of fractured and highly weathered calcrete derived mainly from the Ogallala Formation of Miocene-Pliocene age (fig. 35). Potter soils are on very gently sloping to steep draws, scarps, or valley sides. Slopes range from 1 to 30 percent. The soils are loamy-skeletal, carbonatic, thermic, shallow Petronodic Ustic Haplocalcids.

Typical pedon of Potter gravelly loam on a 3 percent slope; Lubbock County, Texas; from the intersection of Loop 289 and State Highway 331 in southeast Lubbock; 0.2 mile east on paved road; 0.5 mile southeast on private road; 150 feet north into rangeland; along the escarpment of Yellowhouse Canyon; Latitude: 33 degrees, 32 minutes, 1.1 seconds N; Longitude: 101 degrees, 46 minutes, 48.6 seconds W. Lubbock East, Texas USGS quad; NAD 27.

A1—0 to 2 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure and moderate fine granular; slightly hard, friable; many very fine and fine roots; many fine and medium moderately to strongly cemented caliche fragments (22 percent coarse fragments); 30 percent of the soil surface is covered with moderately cemented caliche fragments 1 to 2 inches across the long axis; strongly effervescent; moderately alkaline; gradual smooth boundary.

A2—2 to 6 inches; brown (10YR 5/3) extremely gravelly fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; many very fine and fine roots; few fine pores; many fine and medium calcium carbonate concretions, nodules, and caliche fragments; 30 percent of 2- to 4-inch diameter coarse fragments consisting of moderately to strongly cemented calcium carbonate (63 percent coarse fragments); violently effervescent; moderately alkaline; clear wavy boundary. (combined thickness of the A horizons is 2 to 10 inches)

Bk—6 to 15 inches; light brownish gray (10YR 6/2) and light gray (10YR 7/2) very gravelly fine sandy loam, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) moist; weak fine and medium subangular blocky structure; hard, firm; common very fine and fine roots; few fine pores; 82 percent calcium carbonate equivalent as masses and nodules; about 40 percent of 2- to 4-inch diameter coarse fragments consisting of moderately cemented calcium carbonate; violently effervescent; moderately alkaline; diffuse wavy boundary. (0 to 10 inches thick)

BCk1—15 to 29 inches; white (10YR 8/1) extremely gravelly fine sandy loam, light gray (10YR 7/2) moist; 67 percent by volume, thin platy moderately cemented caliche fragments, 1 to 3 inches across, plates are fractured and undersides have about 0.25 to 0.50 inch long pendants of calcium carbonate; 33 percent of the volume is powdery caliche and loamy materials; few fine and medium roots mainly of woody plants between plates; violently effervescent; strongly alkaline; diffuse wavy boundary. (10 to 30 inches thick)

BCk2—29 to 55 inches; white (10YR 8/1) extremely gravelly fine sandy loam, light gray (10YR 7/2) moist; 74 percent by volume thick, moderately cemented, platy caliche fragments and ranging from 1 to 6 inches on the long axis; 26 percent of the volume is soft powdery caliche and loamy materials; few fine and medium roots mainly of woody plants between fractured plates; common iron oxide stains on undersides of pendants and plates; violently effervescent; strongly alkaline; diffuse wavy boundary. (20 to 30 inches thick)

BCk3—55 to 80 inches; white (10YR 8/1) extremely gravelly fine sandy loam, light gray (10YR 7/2) moist; 75 percent by volume of thick, moderately cemented, platy caliche fragments and ranging from 1 to 6 inches on the long axis; 25 percent of the volume is soft powdery caliche and loamy materials; common iron oxide stains on undersides of pendants and plates; violently effervescent; strongly alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. October through March are the driest months and these soils are intermittently moist in April through September.
Mean annual soil temperature: 59 to 67 degrees F
Depth to calcic horizon: 2 to 10 inches
Solum thickness: 10 to 20 inches
Particle-size control section: 18 to 35 percent silicate clay, averages more than 35 percent coarse fragments

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist (Note: Where the A horizon has a moist color value of less than 3.5, the organic carbon is less than 0.58 percent, or the thickness is less than 7 inches)
Chroma: 2 to 4
Texture: Fine sandy loam, loam, or clay loam or their gravelly, very gravelly, or extremely gravelly counterparts
Coarse fragments: 0 to 70 percent of hard caliche
Calcium carbonate equivalent: 5 to 45 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Figure 35.—Profile of Potter soils, 3 to 20 percent slopes, showing the moderately cemented thin platy cemented caliche fragments and pendants.

Bk horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam, loam, and clay loam
Coarse fragments: 20 to 80 percent of hard caliche having a hardness of slightly less than 3 on Mohs scale
Visible calcium carbonate: 50 to 70 percent as masses and nodules
Calcium carbonate equivalent: 40 to 60 percent and is moderately cemented in some pedons
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

BCk horizon

Hue: 7.5 YR or 10YR
Value: 7 or 8 dry, 6 or 7 moist
Chroma: 1 to 3
Texture: Gravelly, very gravelly, or extremely gravelly fine sandy loam, loam, or clay loam
Coarse fragments: The horizon ranges from 30 to 80 percent by volume of moderately to strongly cemented caliche containing intermingled pockets of pink, loamy, calcareous soil material or soft caliche beds. Pendants of calcium carbonate are on the lower surface of caliche plates in the BCk horizon in some pedons.
Calcium carbonate equivalent: 20 to 80 percent

Geographic setting

Parent material: Calcareous, loamy sediments derived from the upper part of the Ogallala Formation of Miocene-Pliocene age
Landform: Very gently sloping to steep convex hills, ridges, and upper side slopes, around the margin of larger playa lakes, relict drainageways, and along the Caprock Escarpment
Slope: 1 to 30 percent
Mean annual air temperature: 55 to 61 degrees F
Mean annual soil temperature: 57 to 63 degrees F
Mean annual precipitation: 16 to 21 inches
Frost-free period: 190 to 220 days
Elevation: 2,300 to 3,100 feet
Thornthwaite annual P-E index values: 30 to 34
Drainage: Well drained
Permeability: Moderately slow permeability
Surface runoff: Moderate on 1 to 5 percent slopes, high on 5 to 20 percent slopes, and very high on slopes greater than 20 percent

Pullman Series

The Pullman series consists of very deep, well drained, slowly permeable soils that developed in loamy and clayey sediments from the Blackwater Draw Formation of Pleistocene age (fig. 36). These soils are on nearly level or very gently sloping plains. Slopes range from 0 to 3 percent. The soil is fine, mixed, superactive, thermic Torrertic Paleustolls.

Typical pedon of Pullman clay loam, 0 to 1 percent slopes; Deaf Smith County, Texas; from the intersection of U.S. Highway 385 and U.S. Highway 60 in Hereford; 11.5 miles north on Highway 385; 1,000 feet east in cultivated field; Latitude: 35 degrees, 58 minutes, 28.5 seconds N; Longitude; 102 degrees, 24 minutes, 02.2 seconds W; Milo Center, Texas USGS quad; NAD 27.

Ap—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; hard, friable; many fine and medium roots; few very fine and fine iron-manganese concretions; neutral; gradual smooth boundary. (4 to 15 inches thick)

Bt1—5 to 18 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; most peds tilted 10 to 15 degrees from horizontal; very hard, very firm; common very fine and fine roots, few fine tubular pores; common distinct clay films on faces of peds; common pressure faces on ped surfaces; few fine iron-manganese concretions; slightly alkaline; gradual smooth boundary. (6 to 20 inches thick)

Bt2—18 to 33 inches; dark brown (7.5YR 4/3) clay, dark brown (7.5YR 3/3) moist; moderate medium prismatic structure parting to strong medium angular blocky; most peds tilted 10 to 15 degrees from horizontal; very hard, very firm; few very fine and fine roots; few very fine and fine tubular pores; common distinct clay films on faces of peds; common pressure faces on ped surfaces; slightly effervescent; slightly alkaline; gradual smooth boundary. (7 to 18 inches thick)

Btk1—33 to 52 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to strong medium angular blocky; most peds tilted 10 to 15 degrees from horizontal; very hard, very firm; few very fine roots; few very fine and fine tubular pores; common distinct clay films on faces of peds; common pressure faces on ped surfaces; few films, threads, concretions and nodules of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary. (0 to 16 inches thick)

Btk2—52 to 66 inches; strong brown (7.5YR 5/6) clay, strong brown (7.5YR 4/6) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine and fine tubular pores; few faint clay films on faces of peds; about 25 percent calcium carbonate in the form of masses, concretions and nodules; violently effervescent; moderately alkaline; abrupt smooth boundary. (0 to 18 inches thick)

Btk3—66 to 80 inches; reddish yellow (5YR 7/6) clay loam, reddish yellow (5YR 6/6) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few faint clay films on faces of peds; about 40 percent calcium carbonate in the form of masses, concretions and nodules; violently effervescent; moderately alkaline; gradual smooth boundary.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 56 to 62 degrees F
Depth to secondary carbonates: 20 to 30 inches
Depth to calcic horizon: 30 to 60 inches
Thickness of the mollic epipedon: 12 to 30 inches
Solum thickness: More than 80 inches
Particle-size control section: 40 to 55 percent silicate clay

A horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay loam
Effervescence: None
Reaction: Neutral to moderately alkaline

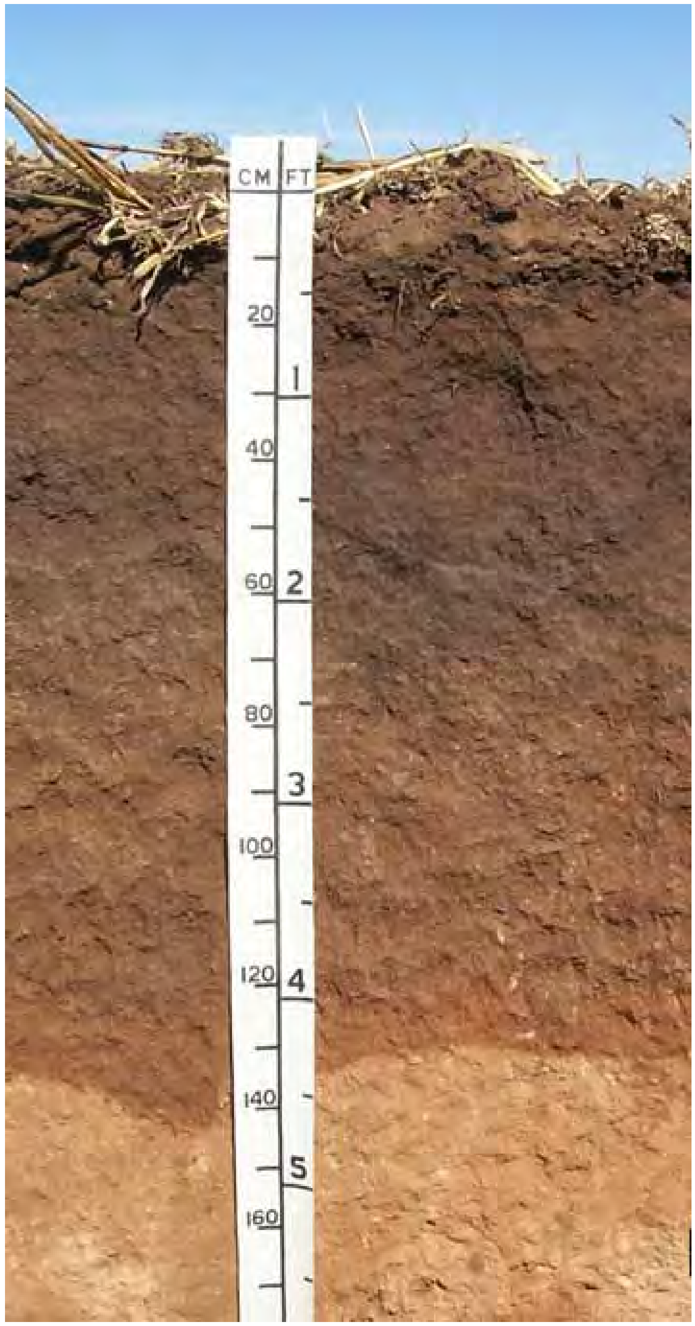

Figure 36.—Profile of Pullman clay loam, 0 to 1 percent slopes, showing minor accumulations of secondary carbonates at about 33 inches and a strong calcic horizon at about 52 inches.

Upper Bt horizon

Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 or 3
Texture: Clay
Effervescence: None
Reaction: Slightly alkaline or moderately alkaline

Lower Bt horizon

Hue: 5YR to 10YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 4 to 6
Texture: Silty clay, clay
Visible calcium carbonate: Less than 2 percent as films, threads, concretions, and nodules
Effervescence: None to slight
Reaction: Slightly alkaline or moderately alkaline

Btk horizon

Hue: 5YR or 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 4 to 6
Texture: Clay loam, silty clay loam, silty clay, clay
Visible calcium carbonate: 2 to 60 percent by volume as films, threads, masses, concretions, and nodules
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Loamy and clayey eolian sediments derived in the Blackwater Draw Formation of Pleistocene age
Landform: Slightly convex nearly level or very gently sloping plains
Slope: range from 0 to 3 percent
Mean annual air temperature: 56 to 62 degrees F
Mean annual precipitation: 17 to 22 inches
Frost-free period: 185 to 220 days
Elevation: 3,000 to 4,000 feet
Thornthwaite annual P-E index values: 25 to 32
Drainage: Well drained
Permeability: Slow permeability
Surface runoff: Medium on 0 to 1 percent slopes and high on 1 to 3 percent slopes

Quay Series

The Quay series consists of deep, well drained soils that developed in moderately fine to medium textured alluvium from red siltstone, shale, and sandstone deposits of the Triassic, Permian, and Pennsylvanian ages. These soils are on convex alluvial fans and footslopes. Slopes range from 0 to 9 percent. The soils are fine-silty, mixed, superactive, thermic Ustic Haplocalcids.

Typical pedon of Quay loam on a 2 percent slope; Quay County, New Mexico; 7 miles south of Tucumcari on SR 209 then 0.5 mile west, or the north quarter corner of sec. 27, T. 10 N., R. 30 E. in rangeland; Latitude: 35 degrees, 04 minutes, 12 seconds N;

Longitude: 103 degrees, 44 minutes, 42 seconds W. Bulldog Mesa Quad, New Mexico USGS quad; NAD 27.

A1—0 to 3 inches; reddish brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) moist; moderate very fine granular structure; soft, friable; few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary. (2 to 5 inches thick)

A2—3 to 9 inches; light reddish brown (5YR 6/3) loam, reddish brown (5YR 4/3) moist; moderate very fine granular structure; soft, friable; common fine roots; slightly effervescent; moderately alkaline; clear smooth boundary. (5 to 10 inches thick)

Bw1—9 to 13 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; common very fine pores, strongly effervescent; moderately alkaline; clear smooth boundary. (3 to 6 inches thick)

Bw2—13 to 19 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary. (5 to 15 inches thick)

Bk—19 to 26 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, slightly firm; common fine roots; common very fine and few fine pores; many fine and medium irregular pinkish white (5YR 8/2) calcium carbonate masses and nodules; violently effervescent; moderately alkaline; clear wavy boundary. (6 to 12 inches thick)

BCk1—26 to 36 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, firm; few fine roots; few very fine pores; many medium irregular pinkish white (5YR 8/2) calcium carbonate masses and nodules; violently effervescent; moderately alkaline; clear smooth boundary. (5 to 12 inches thick)

BCk2—36 to 80 inches; pinkish gray (7.5YR 7/2) clay loam, pinkish gray (7.5YR 6/2) moist; massive; slightly hard, friable; few very fine tubular pores; few fine irregular calcium carbonate masses and nodules; violently effervescent; moderately alkaline.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in all parts for 205 days to 270 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 59 to 64 degrees F

Depth to calcic horizon: 15 to 40 inches

Solum thickness: 40 to 60 inches

Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 2.5YR to 7.5YR

Value: 5 or 6 dry, 3 or 4 moist

Chroma: 3 or 4 (Note: Epipedons with moist value and chroma less than 3.5 are less than 7 inches thick or contain less than 0.6 percent organic carbon)

Texture: Fine sandy loam, loam, silt loam

Silicate clay content: 18 to 35 percent

Calcium carbonate equivalent: 0.5 to 3 percent

Effervescence: Slight

Reaction: Moderately alkaline

Bw horizon

Hue: 2.5YR to 7.5YR

Value: 5 to 7 dry, 3 to 5 moist
Chroma: 2 to 6
Texture: Silt loam, loam, clay loam
Silicate *clay content:* 15 to 34 percent
Calcium carbonate equivalent: 1 to 10 percent
Effervescence: Strong
Reaction: Moderately alkaline

Bk horizon

Hue: 2.5YR to 7.5YR
Value: 5 to 8 dry, 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy clay loam, clay loam, silty clay loam, silty clay, clay
Silicate *clay content:* 35 to 50 percent
Calcium carbonate equivalent: 15 to 30 percent
Visible calcium carbonate: 3 to 20 percent as masses and nodules
Effervescence: Strong or violent
Reaction: Moderately alkaline

BCk horizon

Hue: 5YR to 10YR
Value: 6 to 8 dry, 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy clay loam, clay loam, silty clay loam, silty clay, clay
Silicate clay content: 35 to 50 percent
Visible secondary carbonates: 3 to 20 percent as masses and nodules
Calcium carbonate equivalent: 15 to 30 percent
Effervescence: Violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Developed in moderately fine to medium textured calcareous alluvium derived from red siltstone, shale, and sandstone from the Triassic, Permian, and Pennsylvanian ages
Landform: On convex alluvial fans and footslopes
Slope: 0 to 9 percent
Mean annual air temperature: 58 to 62 degrees F
Mean annual precipitation: 13 to 16 inches
Frost-free period: 180 to 190 days
Elevation: 4,000 to 5,500 feet
Thornthwaite annual P-E index values: 20 to 25
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes, low on 1 to 5 percent slopes, and medium on 5 to 9 percent slopes

Randall Series

The Randall series consists of very deep, poorly drained, very slowly permeable soils that developed in clayey lacustrine sediments derived from the Blackwater Draw Formation of Pleistocene age. These nearly level soils are on the floor of playa basins 10 to 50 feet below the surrounding plain and range from 10 to more than 150 acres. Slopes are 0 to 1 percent. The soils are fine, smectitic, thermic Ustic Epiaquerts.

Typical pedon of Randall clay on a 0.2 percent slope; Floyd County, Texas; From the intersection Farm Road 784 and U.S. Highway 70 in Floydada; 4.3 miles west on Farm Road 784; 1.1 miles south on ranch road; 300 feet south in playa (Bois d-Arc Lake); Latitude: 33 degrees, 57 minutes, 44.13 seconds N; Longitude: 101 degrees, 24 minutes, 57.72 seconds W. Sandhill, Texas USGS quad; NAD 27.

A1—0 to 3 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine granular structure and moderate medium subangular blocky; very hard, very firm; few fine roots; common strong brown (7.5YR 5/6) masses of iron accumulation in pore linings and on faces of peds; few fine black (10YR 2/1) iron-manganese masses; slightly acid; clear smooth boundary.

A2—3 to 9 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine and medium angular blocky structure; very hard, very firm; few fine roots; few strong brown (7.5YR 5/6) masses of iron accumulation in pore linings and on faces of peds; few fine black (10YR 2/1) iron-manganese masses; neutral; gradual smooth boundary. (combined thickness of the A horizons is 5 to 15 inches)

Bw—9 to 17 inches; very dark gray (10YR 4/1) clay, dark gray (10YR 5/1) dry; moderate fine and medium angular blocky structure; very hard, very firm; few fine roots; few fine tubular pores; few strong brown (7.5YR 5/6) masses of iron accumulation in pore linings and on faces of peds; few fine black (10YR 2/1) iron-manganese masses; neutral; clear wavy boundary. (0 to 10 inches thick)

Bss1—17 to 38 inches; very dark gray (10YR 4/1) clay, dark gray (10YR 5/1) dry; moderate coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky; extremely hard, very firm; common distinct slickensides; cracks 0.5 inch wide extend through the horizon; few fine roots; few fine tubular pores; few fine black (10YR 2/1) iron-manganese masses and concretions; neutral; gradual wavy boundary. (5 to 20 inches thick)

Bss2—38 to 51 inches; dark gray (2.5Y 4/1) clay, gray (2.5Y 5/1) dry; moderate coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; few fine tubular pores; few vertical lenses up to 10 mm wide of gray (10YR 4/1) crack fill material; common distinct slickensides; cracks 0.5 inch wide extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; neutral; gradual wavy boundary. (5 to 20 inches thick)

Bss3—51 to 62 inches; dark gray (2.5Y 4/1) clay, gray (2.5Y 5/1) dry; moderate coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky; extremely hard, very firm; few fine tubular pores; few vertical lenses up to 10 mm wide of gray (10YR 4/1) crack fill material; common distinct slickensides; cracks 0.5 inch wide extend through the horizon; about 1 percent fine masses and nodules of calcium carbonate; slightly effervescent; moderately alkaline; gradual wavy boundary. (combined thickness of the Bss horizons is 20 to 60 inches)

Bkss—62 to 80 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; moderate coarse and very coarse wedge-shaped aggregates parting to weak medium angular blocky; extremely hard, very firm; few fine tubular pores; few vertical lenses up to 10 mm wide of gray (10YR 4/1) crack fill material; common distinct slickensides; about 3 percent fine masses and nodules of calcium carbonate; few grayish brown (2.5Y 5/2) iron depletions on ped surfaces; slightly effervescent; moderately alkaline.

Soil moisture: An aquic moisture regime. These soils receive runoff from surrounding uplands and are moist for longer periods than normal for the climate. The soil cracks and is dry in parts of the upper 50 cm for more than 90 cumulative days in normal years. July through August and November through March are the driest months.

These soils are intermittently moist in September through October and April through June.
Mean annual soil temperature: 57 to 67 degrees F
Depth to secondary calcium carbonate: 10 to more than 60 inches
Depth to redox concentrations: 0 to 5 inches and range from few to many
Depth to redox depletions: 0 to 16 inches and range from none to common
Depth to episaturation: 0 to 20 inches
Depth to slickensides: 5 to 25 inches
Solum thickness: More than 80 inches
Particle-size control section: 50 to 60 percent silicate clay

(Note: This is a cyclic soil and undisturbed areas have gilgai microrelief with microknolls 3 to 5 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 20 percent, the intermediate, or area between the knoll and depression, about 40 percent, and the microdepression about 40 percent. Cracks open and close each year except during higher than normal rainfall years, and remain open for 90 or more cumulative days during most years. If dry, 0.4 to 2 inch wide cracks extend from the surface to a depth of 40 inches or more. Cracks are more prominent in the microdepressions. COLE greater than 0.07. The range in characteristics represents 50 percent or more of each pedon unless otherwise stated.)

A horizon

Hue: 7.5YR or 10YR
Value: 2 to 4 moist, 3 to 5 dry
Chroma: 1 or 2
Texture: clay
Redoximorphic concentrations: Masses of iron-manganese and oxidized rhizospheres range from few to many
Redox depletions: Iron depletions on ped surfaces and in root pores range from none to common
Effervescence: None to strong
Reaction: Slightly acid to slightly alkaline

Bw horizon (where present)

Hue: 10YR to 5Y or N
Value: 3 to 6 moist, 4 to 7 dry
Chroma: 1 or less (Note: After periods of prolonged saturation pedons become gleyed and have neutral colors with moist color value of 4 to 6)
Texture: Clay
Redoximorphic concentrations: Masses of iron-manganese and oxidized rhizospheres range from few to common
Effervescence: None to strong
Reaction: Neutral to moderately alkaline

Bss horizon

Hue: 10YR to 5Y or N
Value: 4 to 6 moist, 5 to 7 dry
Chroma: 2 or less (Note: After periods of prolonged saturation pedons become gleyed and have neutral colors with moist color value of 4 to 6)
Texture: Clay
Redoximorphic concentrations: Masses of iron-manganese and oxidized rhizospheres range from none to common
Effervescence: None to strong
Reaction: Neutral to moderately alkaline

Bkss horizon (where present)

Hue: 10YR to 5Y
Value: 4 to 7 moist, 5 to 8 dry
Chroma: 2 or less
Texture: Clay
Redoximorphic concentrations: Masses of iron-manganese and oxidized rhizospheres range from none to common.
Calcium carbonate equivalent: Less than 15 percent
Visible calcium carbonate: 3 to 10 percent as threads, masses, or nodules
Effervescence: Strong or violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Clayey lacustrine sediments derived from the Blackwater Draw Formation of Pleistocene age
Landform: In playas 10 to 50 feet below the surrounding plain and range from 10 to more than 150 acres
Slope: 0 to 1 percent
Mean annual air temperature: 55 to 65 degrees F
Mean annual precipitation: 16 to 26 inches
Frost-free period: 180 to 226 days
Elevation: 1,900 to 4,500 feet
Thornthwaite annual P-E index values: 24 to 34
Drainage: Poorly drained
Permeability: Very slow permeability
Surface runoff: Negligible (Note: These soils pond for very long periods in most years)

Redona Series

The Redona series consists of very deep, well drained, moderately permeable soils that developed in moderately fine textured calcareous alluvium derived from red siltstone, shale, and sandstone of Triassic age. These soils are on hillslopes, alluvial fan terraces, and valley side slopes. Slopes range from 0 to 5 percent. The soils are fine-loamy, mixed, superactive, thermic Ustic Calciargids.

Typical pedon of Redona fine sandy loam on a 2 percent slope; Quay County, New Mexico; about 4 miles south of Tucumcari on New Mexico Highway 18, 0.25 mile east on fence line, then 0.5 mile north of southwest corner, or sec. 15, T. 10 N., R. 30 E. in rangeland; Latitude: 35 degrees, 08 minutes, 12 seconds N; Longitude: 103 degrees, 44 minutes, 31 seconds W. Bulldog Mesa, New Mexico USGS quad; NAD 27.

A—0 to 10 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak thin platy structure in the upper 2 inches parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots; common very fine and fine pores; noneffervescent; slightly alkaline; clear smooth boundary. (4 to 12 inches thick)

Bt1—10 to 24 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky, and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; common clusters of fine rounded insect casts; many thin clay coatings on sand grains and as bridges between the grains; noneffervescent; slightly alkaline; clear smooth boundary. (12 to 20 inches thick)

Bt2—24 to 28 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; common very fine and fine roots; many very fine and fine pores; common clusters of fine rounded insect casts; many thin clay coatings on sand grains and as bridges between the grains; strongly effervescent; few fine calcium carbonate masses; slightly alkaline; abrupt wavy boundary. (0 to 15 inches thick)

Bk1—28 to 50 inches; pink (5YR 8/3) and light reddish brown (5YR 6/4) clay loam, pink (5YR 7/3) and reddish brown (5YR 5/4) moist; moderate medium subangular blocky structure; very hard, friable, slightly sticky and plastic; few very fine roots; common very fine and fine pores; few very fine and fine pebbles; violently effervescent; few very fine calcium carbonate masses and nodules; strongly alkaline; clear wavy boundary. (15 to 25 inches thick)

Bk2—50 to 80 inches; light reddish brown (5YR 6/4) and pink (5YR 8/3) clay loam, reddish brown (5YR 5/4) and pink (5YR 7/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; common very fine and fine pores; violently effervescent; few fine calcium carbonate masses and nodules; moderately alkaline.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in all parts for 205 days to 270 days, cumulative, in normal years. The soil is intermittently moist in some part of the soil moisture control section May through October. The soil is driest November through April. July and August are the months when the soil is moist for the longest periods.
Mean annual soil temperature: 60 to 72 degrees F
Depth to calcic horizon: 20 to 40 inches
Solum thickness: More than 80 inches
Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 5YR or 7.5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 to 5
Texture: Sandy loam, fine sandy loam, sandy clay loam, loam
Effervescence: None
Reaction: Slightly alkaline

Bt horizon

Hue: 2.5YR to 7.5YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 3 to 6
Texture: Sandy clay loam, loam, clay loam
Calcium carbonate equivalent: 0 to 10 percent
Rock fragments: Less than 15 percent
Effervescence: None to strong
Reaction: Slightly alkaline

Btk horizon

Hue: 2.5YR to 7.5YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 3 to 6
Texture: Sandy clay loam, loam, clay loam
Calcium carbonate equivalent: 15 to 25 percent
Rock fragments: Less than 15 percent
Effervescence: Strong to violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 8 dry, 3 to 8 moist
Chroma: 2 to 6
Texture: Sandy clay loam, loam, clay loam
Calcium carbonate equivalent: 15 to 25 percent
Rock fragments: Less than 15 percent
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting

Parent material: Moderately fine textured calcareous alluvium derived from red siltstone, shale and sandstone from the Triassic period
Landform: On slightly convex alluvial fans, terraces, and valley slopes
Slope: 0 to 5 percent.
Mean annual air temperature: 58 to 70 degrees F
Mean annual precipitation: 12 to 16 inches
Frost-free period: 180 to 220 days
Elevation: 3,600 to 5,300 feet
Thornthwaite annual P-E index values: 20 to 25
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes, very low on 1 to 3 percent slopes, and low on 3 to 5 percent slopes

Tucumcari Series

The Tucumcari series consists of very deep, well drained, moderately slowly permeable soils that developed in moderately fine textured calcareous alluvium derived from red siltstone, shale, and sandstone from the Triassic, Jurassic, Cretaceous, Tertiary, and Quaternary ages that may have been altered by wind. These soils are on slightly convex alluvial fans, the lower part of pediments, hills, and swales. Slopes range from 0 to 5 percent. The soils are fine, smectitic, thermic Ustertic Haplargids.

Typical pedon of Tucumcari loam on a 1 percent slope; De Baca County, New Mexico; 6.5 miles east of the intersection of U.S. Highway 84 and U.S. Highway 60 in Fort Sumner to La Lande, then approximately 17 miles south of La Lande, or 2,200 feet north and 1,100 feet east of the southwest corner of sec. 29, T. 15, R. 27 E. in rangeland; Latitude: 34 degrees, 11 minutes, 32 seconds N; Longitude: 104 degrees, 07 minutes, 51 seconds W. Eighteen Mile Hill, New Mexico USGS quad; NAD 27.

A—0 to 5 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate fine granular structure; soft, very friable, sticky and plastic; many very fine and fine roots; strongly effervescent; disseminated calcium carbonate; moderately alkaline; clear smooth boundary. (5 to 15 inches thick)

Btk1—5 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, very sticky and plastic; common fine roots; few very fine pores; few distinct clay films on faces of peds; strongly effervescent; disseminated calcium carbonate; moderately alkaline; gradual wavy boundary.

Btk2—16 to 30 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium and coarse subangular blocky; very hard, firm, very sticky and very plastic; few fine roots; common very fine pores; few distinct clay films on faces of peds; strongly effervescent; disseminated calcium carbonate; moderately alkaline; gradual wavy boundary.

Btk3—30 to 45 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, very sticky and very plastic; few fine roots; common very fine pores; few distinct clay films on faces of peds; strongly effervescent; few fine filaments of calcium carbonate; moderately alkaline; gradual wavy boundary. (combined thickness of Btk horizons is 27 to 50 inches)

Bk—45 to 80 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; weak medium and coarse subangular blocky structure; very hard, firm, very sticky and very plastic; strongly effervescent; few fine threads or filaments of calcium carbonate; moderately alkaline.

Soil moisture: An aridic moisture regime bordering on ustic. The soil moisture control section is dry in all parts for 190 days to 220 days, cumulative, in normal years. The soil is intermittently moist in some part of the soil moisture control section May through October. The soil is driest November through April when less than 33 percent of the total precipitation falls.
Mean annual soil temperature: 58 to 60 degrees F
Calcium carbonate equivalent: 1 to 15 percent
Solum thickness: 40 to 80 inches
Vertic properties: COLE ranges from 0.06 to about 0.08
Particle-size control section: 35 to 50 percent silicate clay

A horizon

Hue: 2.5YR to 7.5YR
Value: 3 to 5 dry, 2 to 4 moist
Chroma: 3 or 4
Texture: Clay loam, silty clay loam, loam, sandy clay loam
Silicate clay content: 25 to 40 percent
Calcium carbonate equivalent: 1 to 3 percent
Effervescence: Strong
Reaction: Moderately alkaline

Btk horizon

Hue: 2.5YR to 7.5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: Clay loam, sandy clay loam, silty clay loam, clay, silty clay
Silicate clay content: 35 to 50 percent
Calcium carbonate equivalent: Less than 15 percent as threads and films
Effervescence: Strong
Reaction: Moderately alkaline

Bk horizon

Hue: 2.5YR, 5YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 to 6
Texture: Clay loam, sandy clay loam
Silicate clay content: 25 to 40 percent
Calcium carbonate equivalent: 15 to 30 percent
Effervescence: Strong to violent
Reaction: Moderately alkaline

Geographic setting

Parent material: Moderately fine textured calcareous alluvium derived from red siltstone, shale, and sandstone from the Triassic, Jurassic, Cretaceous, Tertiary, and Quaternary ages that may have been altered by wind
Landform: On slightly convex alluvial fans and valley-filling slopes
Slope: 0 to 5 percent.
Mean annual air temperature: 56 to 62 degrees F
Mean annual precipitation: 12 to 16 inches
Frost-free period: 180 to 200 days
Elevation: 3,800 to 5,300 feet
Thornthwaite annual P-E index values: 24 to 31
Drainage: Well drained
Permeability: Moderately slow permeability
Surface runoff: Low on 0 to 1 percent slopes

Veal Series

The Veal series consists of very deep, well drained, moderately permeable soils that formed in calcareous slope alluvium and colluvium derived from the Ogallala Formation of Miocene-Pliocene age. These soils are on very gently sloping to moderately steep scarps, knolls, and valley sides. Slopes range from 1 to 20 percent. The soils are fine-loamy, carbonatic, thermic Aridic Calciustepts.

Typical pedon of Veal fine sandy loam on a 1 percent slope; Howard County, Texas; approximately 20 miles north-northwest of Big Spring, 2.7 miles west-southwest of Vealmoor on Farm Road 1785, 100 feet north of Farm Road 1785; or 0.7 mile west-southwest of the southeast corner of section 22, block 33, T-3-N, 100 feet north in pasture; Latitude: 32 degrees, 30 minutes, 25 seconds N; Longitude: 101 degrees, 37 minutes, 3 seconds W. Vealmoor, Texas USGS quad; NAD 27.

A—0 to 8 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky and granular structure; slightly hard, friable; common fine roots; common fine pores; about 1 percent of less than 1 inch across coarse fragments consisting of moderately cemented calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary. (5 to 10 inches thick)
Bk1—8 to 17 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots, few fine pores; about 20 percent fine nodules of calcium carbonate; violently effervescent; moderately alkaline; clear wavy boundary. (5 to 14 inches thick)
Bk2—17 to 36 inches; pink (7.5YR 8/4) sandy clay loam, pink (7.5YR 7/4) moist, weak medium subangular blocky structure; slightly hard, friable; about 50 percent fine and medium masses and nodules of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary. (12 to 40 inches thick)
Bk3—36 to 80 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; weak medium subangular blocky structure; slightly hard, friable; about 50 percent fine and medium masses and nodules of calcium carbonate; violently effervescent; moderately alkaline.

Soil moisture: An ustic moisture regime bordering on aridic. The soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. October through March are the driest months. These soils are intermittently moist in April through September.
Mean annual soil temperature: 57 to 65 degrees F
Depth to secondary calcium carbonate: 0 to 10 inches
Depth to calcic horizon: 10 to 24 inches

Solum thickness: 40 to 60 inches
Particle-size control section: 18 to 35 percent silicate clay

A horizon

Hue: 5YR to 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam, loam, clay loam
Coarse fragments: 0 to 12 percent
Calcium carbonate equivalent: 15 to 30 percent
Effervescence: Violent
Reaction: Neutral to moderately alkaline

Bk horizon

Hue: 5YR to 10YR
Value: 5 to 8 dry, 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, sandy clay loam, clay loam
Coarse fragments: 0 to 12
Visible calcium carbonate: 10 to 50 percent in the form of masses and nodules
Calcium carbonate equivalent: 15 to 60 percent and is weakly cemented in some pedons
Effervescence: Violent
Reaction: Moderately alkaline or strongly alkaline

Geographic setting:

Parent material: Calcareous, loamy alluvial and colluvial sediments derived from the Ogallala Formation of Miocene-Pliocene age
Landform: Nearly level to moderately steep backslopes and upper footslopes below the caliche-capped eastern margins of the Southern High Plains and similar hillslope positions along drainageways from the Canadian River southward
Slope: Dominantly 3 to 8 percent but range from 0 to 20 percent
Mean annual air temperature: 57 to 65 degrees F
Mean annual precipitation: 16 to 22 inches
Frost-free period: 180 to 220 days
Elevation: 2,200 to 3,750 feet
Thornthwaite annual P-E index values: 30 to 34
Drainage: Well drained
Permeability: Moderate permeability
Surface runoff: Negligible on 0 to 1 percent slopes, very low on 1 to 3 percent slopes, low on 3 to 5 percent slopes, and medium on 5 to 20 percent slopes

Formation of the Soils

In this section, the factors of soil formation, which have affected the soils of Deaf Smith County, are discussed.

Factors of Soil Formation

Soils are three-dimensional bodies on the Earth’s surface that are capable of supporting plants. Soil properties result from the parent material and from additions, removals, transfers, and transformations to the soil caused by climate, living organisms, topography, and time. Human activities may also be important.

The interaction of the four soil-forming factors results in differences among the soils. Climate and living organisms (plants and animals) are the active factors. They act on the parent material by influencing the weathering of rocks and through subsequent transportation of the material by water and wind. They slowly change the parent material into a natural body with genetically related horizons. The effects of climate and living organisms are influenced by the topography. Soils on flood plains, for example, are quite different from those on well drained hillslopes. The parent material also affects the kind of profile that can form and sometimes determines it almost entirely. Finally, time is needed to change parent material into soil. Generally, thousands of years are needed for distinct horizons to form.

Climate

Deaf Smith County has a steppe climate yes the word steppe comes from the same kind of dry climate as in parts of Russia’s treeless plains and mild winters. The average rainfall is about 19 inches, but the amount varies greatly from year to year. The climate is uniform throughout the county, but its effects on soils have been modified locally by topography and runoff, and the differences generally are not measurably affected by climate.

Because rainfall is low and there are long dry periods, soil development has been slow. Soils are seldom wet below the root zone, and consequently, most of the soils have a horizon of calcium carbonate accumulation. In Lofton, Olton, and Pullman soils, the carbonates are leached from the surface and the upper part of the subsoil layers. Most soils have the layer of calcium carbonate, or caliche, at a depth of 20 to 60 inches. In Drake, Pep, and Portales soils, free calcium carbonate is present throughout the profile. In relatively younger soils, such as Pantex, and soils within depressions, such as Bippus and Randall, the carbonates have generally been leached to below a depth of 60 inches.

Winds have played an important role in the development of the soils of Deaf Smith County. Most of the parent sediments were deposited by wind during past geologic periods. Even today, high winds remove and deposit soil particles. Winds also are effective in recharging the soils with calcium carbonate as dust particles, thereby keeping the pH of the soils high. Locally, high winds deposited soil materials on the eastern and southern sides of some larger playas. Drake soils have formed in these sediments.

Warm temperatures have restricted the accumulation of organic matter in most of the soils, although they formed under prairie vegetation. Oxidation tends to accelerate the decomposition of organic matter. Sandy soils, such as Berwolf, Ima, Minneosa, and Mobeetie, are low in organic matter. Bippus, Lofton, Pantex, Pullman, and Randall soils are relatively high in organic matter.

Living Organisms

Plants, animals, earthworms, and microorganisms are important in the formation of soils. The type and amount of plant growth is related to the climate, topography, and parent material. The native vegetation in Deaf Smith County is mostly grasses; some shrubs and a few small trees are also present. The type of grasses that grow on a particular kind of soil depends partly on the parent material. Short grasses grow on Pullman and similar soils that have high clay content. Tall grasses grow on Berwolf and other sandy soils.

Prairie-type vegetation contributes relatively large amounts of organic matter to soils. Grass leaves and stems fall on the soil surface and decay. Roots decompose and distribute organic matter throughout the profile and provide abundant food for microorganisms. Insect casts and voids formed from decaying plant roots add greatly to the movement of air and water through the profile.

Prairie dogs affect soil development by their burrowing activities. The animals churn and mix the soil material. Krotovinas, or soil-filled animal burrows, are common in the subsoil of most of the soils in the county. Such calcareous soils as Drake, Pep, and Portales have more krotovinas than do most other soils.

Topography

Topography, or lay of the land, influences the formation of soils through its effect on drainage, runoff, and erosion. The topography of Deaf Smith County ranges from nearly level, flat areas to steep, dissected areas.

If other factors of soil formation are equal, the degree of profile development depends largely on the moisture that enters the soil system. Steep soils absorb less moisture and are more susceptible to erosion than soils in more level areas. Therefore, most steep soils have thinner, less developed profiles.

Nearly level to gently sloping soils, such as Olton, Pantex, and Pullman, permit most of the rainfall to infiltrate; therefore, they are well-developed. Glenrio, Mobeetie, Veal, and Potter soils are steeper, and runoff and geologic erosion have been high; therefore, they are only weakly to moderately developed.

Soils in low, concave areas also show the influence of topography upon their development. Bippus and Lofton soils are darker in color and have more organic matter than soils in higher areas because extra water has produced more vegetation in these low areas. Soils in poorly drained areas, such as Randall and McLean soils in playas, show the influence of excess water on soil development and profile morphology.

Time

Usually thousands of years are required for the formation of distinct horizons in soils. Differences in the length of time that parent material has been in place are generally reflected in the degree of development of the soil profile. The soils in Deaf Smith County range from weakly developed to well-developed. The weakly developed soils have little horizon development. Conversely, the well-developed soils have well-expressed soil horizons. Berda, Drake, and Mobeetie soils are weakly developed soils as reflected in their weak horizonation. Silicate clay accumulation in the B-horizons is not perceptible. Olton, Pantex, and Pullman soils are well-developed. These soils have well-expressed horizons, and silicate clay has been translocated from the surface horizon into the subsoil.

Parent Material

The kind of soil that forms in any given area depends greatly on the kind of parent material in that area. Parent material is the unconsolidated mass from which a soil is formed. It determines the chemical and mineralogical composition of a soil to a considerable extent.

The soils in Deaf Smith County developed mostly in a thick eolian mantle, the Blackwater Draw Formation that blankets most of the county. This mantle was formerly referred to collectively as “cover sands” (Lotspeich,1962.

Estacado, Olton, Pantex, and Pullman soils developed in the eolian mantle. In areas that have more caliche or where caliche layers are closer to the surface, Friona, Kimberson, and Pep soils have developed. Portales soils formed in loamy, calcareous sediments generally associated with playas. Randall and McLean soils formed in clayey sediments on the playa floor. On the eastern and southern side of many playa basins, a dune of relatively recent loamy, calcareous material occurs. Drake soils have formed in these dunes in Holocene time.

The top of the Ogallala Formation is the thick layer of indurated caliche, or “caprock,” that is prominent along the eastern margin of the High Plains and the edge of larger drainageways (Frye, 1957). Potter soils have developed in the degrading indurated caliche. Areas of the Ogallala below the exposed caliche are an erosional surface where alluvial or colluvial sediments have formed Berda, Mobeetie, Plemons, and Veal soils.

Below the caprock are Triassic sediments, primarily from the Chinle Formation, that occur in the northwestern part of the county near Glenrio (anonymous, 1992). Berwolf, Glenrio, Ima, Quay, Redona, and Tucumcari soils formed in material weathered from Triassic sandstone and shale. The geology of the parent material in Deaf Smith County is described in more detail in the section “Surface Geology.”

Processes of Soil Formation

The soil forming factors produce a succession of layers, or horizons, in the soil profile. The horizons differ in one or more properties, such as thickness, color, texture, structure, consistence, porosity, and reaction.

Most profiles have three major horizons or layers. These are the A, B, and C horizons. Several processes are involved in the formation of these horizons. In Deaf Smith County, the main processes are the leaching of calcium carbonate and other salts and bases, the accumulation of organic matter, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of the horizons.

The A horizon is the surface layer. It is the horizon that has the maximum accumulation of organic matter. The soils in Deaf Smith County range from low to high in organic matter content. Various dissolved or suspended materials, such as calcium carbonate, organic matter, salt, and clay, may have been translocated out of the A horizon into the B horizon.

The B horizon lies directly below the A horizon. It is the horizon that has the maximum accumulation of materials moved in solution or suspension, or it is an altered horizon with distinct structure. A Bk horizon has an accumulation of calcium carbonate, which is commonly called caliche. Most of the soils have a Bk horizon. A Bkm horizon indicates continuous or nearly continuous cementation of calcium carbonate that is physically root-restrictive. Friona and Kimberson have a Bkm horizon. A Bt horizon has a significant accumulation of silicate clay. Olton, Pantex, Pullman, and Redona soils have a Bt horizon. Subsoil layers that have a distinct structure and little evidence of accumulation of dissolved or suspended materials are designated as Bw horizons. Bippus and Berda soils have a Bw horizon. Subsoil layers that have slickensides, which are a direct result from the shrinking and swelling of clay minerals and shear failure, commonly at angles of 20 to 60 degrees above horizontal, are designated as Bss horizons. Lazbuddie, McLean, and Randall soils have Bss horizons.

The C horizon is little affected by soil-forming processes. It consists mainly of unconsolidated sediments or weathered or soft bedrock that can be dug with a spade when moist. Minneosa soils have a C horizon. A Cr layer is weathered or soft bedrock, such as shale, siltstone, sandstone, or weakly cemented bedrock. Glenrio soils have a Cr layer. An R layer is strongly cemented or indurated bedrock such as sandstone or limestone. Lacoca soils have an R layer.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

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 fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

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.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control is extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

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.

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. 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 planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

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.

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 more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

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.

Canyon. A long, deep, narrow, very steep sided 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 but 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. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

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 centimeters) 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 in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

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 slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff 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 centimeters) in diameter.

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 centimeters) in diameter. 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. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or 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 common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Congeliturbate. Soil material disturbed by frost action.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. 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.

Corrosion. 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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

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.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cryptogams. Plants in the group of mosses, lichens, and ferns.

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.

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 to rock (in tables). Bedrock is too near the surface for the specified use.

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.

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.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct potential 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 soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

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 (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

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. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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. 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. The normal flood plain of a stream, subject to frequent or occasional 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 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. 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.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of 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 millimeters to 7.6 centimeters) in diameter. 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 centimeters) in diameter.

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 miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

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 out. To form a flower head.

Head slope. 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.

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 natural elevation 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; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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.

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 formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are 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. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only 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. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

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.

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.

Knoll. A small, low, rounded hill rising above adjacent landforms.

K-sat. 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.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. 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 centimeters) 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.

Leeward. The side or slope sheltered or located away from the wind; downwind.

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. Fine grained material, dominantly of silt-sized particles, deposited by wind.

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.

Low strength. The soil is not strong enough to support loads.

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. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

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 upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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. An area 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 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch);* and *coarse, more than 15 millimeters (about 0.6 inch)*.

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

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. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

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

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.

Parna. A term used, especially in southeast Australia and the southwestern USA, for silt and sand-sized aggregrates of eolian clay occurring as sheets.

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 thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

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.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

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:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 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

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Playa dune. A linear or curvilinear ridge of windblown, granular material (generally sand or parna) removed from the adjacent basin by wind erosion (deflation), and deposited on the leeward (prevailing downwind) margin of a playa, playa basin, or salina basin. The dune may be barren or vegetated.

Playa floor. The lowest extensive, flat to slightly concave surface within a playa basin, consisting of a dry lake bed or lake plain underlain by stratified clay, silt, or sand, and commonly by soluble salts.

Playa lake. A shallow, intermittent lake in an arid or semiarid region, covering or occupying a playa in the wet season but subsequently drying up; an *ephemeral lake* that upon evaporation leaves or forms a playa. Syn: *playa*

Playa rim. The convex, upper margin (shoulder) of a playa basin where the playa slope intersects the surrounding terrain.

Playa slope. The generally concave to slightly convex area within a playa basin that lies between the relatively level playa floor below (or playa step, if present) and the convex playa rim above. Overland flow is typically parallel down slope.

Playa step. The relatively level or gently inclined “terrace-like” bench or toeslope within a large playa basin flanking and topographically higher than the playa floor and below the playa slope; a bench or step-like surface within a playa basin that breaks the continuity of the playa slope and is modified by erosion and/or deposition. Temporary ponding may occur in response to precipitation/runoff events.

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.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

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 in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The 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. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

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 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Salina. (a) A place where crystalline salt deposits are formed or found, such as a salt flat or pan, a salada, or a salt lick; esp. a salt-encrusted playa or a *wet playa*. (b) A body of saline water, such as a salt pond, lake, well, or spring, or a playa lake, that has a high concentration of salts.

Saline lake. An inland body of water situated in an arid or semiarid region, having no outlet to the sea, and containing a high concentration of dissolved salts (principally sodium chloride). See also: *Salina*

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline-Sodic Soil. A soil containing sufficient exchangeable sodium to interfere with the growth of most crop plants and containing appreciable quantities of soluble salts. The exchangeable sodium ratio is greater than 0.15, conductivity of the soil solution, at saturated water content, of >4dSm-1 (at 25º C.) and the pH is usually 8.5 or less in the saturated soil.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

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.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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 formed by the hardening of a clay deposit.
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 position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.
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.
Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.
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 in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.
Siltstone. Sedimentary rock made up of dominantly silt-sized particles.
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 depression in the landscape where limestone has been dissolved.
Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.
Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.
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 45 percent
Very steep	45 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.
Slow intake (in tables). The slow movement of water into the soil.
Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.
Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of 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 over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes, 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. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

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. The part of the soil below the solum.

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 centimeters). 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. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

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. 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 (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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 position that forms 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.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

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.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

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 and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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.

Windward. The side located toward the direction from which the wind is blowing; facing the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Hereford, Texas)

Month	Temperature (Degrees F)						Precipitation (Inches)				
				2 years in 10 will have				2 years in 10 will have			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than	Minimum temperature less than	Average number of growing degree days*	Average	less than	more than	Average number of days w/.1 or more	Average Snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January--	49.6	21.4	35.5	75	1	5	0.50	0.13	0.93	1	3.7
February-	54.8	24.9	39.9	79	2	18	0.50	0.20	0.94	1	2.7
March----	63.0	31.2	47.1	86	12	74	0.98	0.19	1.65	2	1.3
April----	71.4	39.5	55.5	92	23	211	1.02	0.33	1.77	2	0.6
May------	79.7	50.0	64.8	98	34	459	2.16	0.80	3.43	4	0.0
June-----	88.2	59.1	73.7	104	46	711	2.90	1.15	4.54	5	0.0
July-----	90.9	63.5	77.2	102	55	841	2.06	0.74	3.16	3	0.0
August---	88.6	62.2	75.4	100	54	780	3.22	1.28	4.85	4	0.0
September	82.0	54.5	68.2	97	36	548	2.25	1.01	3.45	3	0.0
October--	72.4	42.7	57.6	91	24	264	1.59	0.42	2.62	2	0.2
November-	59.4	30.5	44.9	82	12	52	0.76	0.22	1.35	2	1.5
December-	50.4	22.9	36.7	75	2	8	0.74	0.24	1.34	1	3.8
Yearly:											
Average-	70.9	41.9	56.4	---	---	---	---	---	---	---	---
Extreme-	108	-9	---	105	-3	---	---	---	---	---	---
Total--	---	---	---	---	---	3,970	18.67	14.76	22.17	30	13.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Hereford, Texas)

Probability	Temperature 24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 7	April 13	May 4
2 years in 10 later than--	April 1	April 9	April 29
5 years in 10 later than--	March 21	April 2	April 19
First freezing temperature in fall:			
1 year in 10 earlier than--	October 29	October 17	October 3
2 years in 10 earlier than--	November 4	October 23	October 9
5 years in 10 earlier than--	November 15	November 3	October 19

Table 3.--Growing Season

(Recorded for the period 1971-2000 at Hereford, Texas)

Probability	Daily Minimum Temperature: Number of days higher than 24°F	Number of days higher than 28°F	Number of days higher than 32°F
	Days	Days	Days
9 years in 10	215	197	167
8 years in 10	223	203	172
5 years in 10	238	215	182
2 years in 10	254	226	192
1 year in 10	262	233	197

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
BcA	Bippus clay loam, 0 to 2 percent slopes, occasionally flooded	11,526	1.2
BeD	Berda loam, 5 to 8 percent slopes	2,776	0.3
BfB	Berwolf loamy fine sand, 1 to 3 percent slopes	2,093	0.2
BP	Borrow pits	220	*
BpD	Berda-Potter complex, 2 to 12 percent slopes	8,693	0.9
BVD	Berda-Veal association, 3 to 8 percent slopes	1,083	0.1
DRC	Drake soils, 1 to 8 percent slopes	3,060	0.3
EcA	Estacado clay loam, 0 to 1 percent slopes	53,500	5.6
FrB	Friona loam, 1 to 3 percent slopes	500	*
GQE	Glenrio-Quay association, 5 to 15 percent slopes	8,739	0.9
IMC	Ima and Lacoca loamy fine sands, 1 to 8 percent slopes	3,216	0.3
KmB	Kimberson gravelly loam, 0 to 3 percent slopes	8,545	0.9
LcA	Lazbuddie clay, 0 to 1 percent slopes	5,633	0.6
LoA	Lofton clay loam, 0 to 1 percent slopes	12,979	1.4
M-W	Miscellaneous water	22	*
McA	McLean clay, 0 to 1 percent slopes, occasionally ponded	5,641	0.6
MNA	Minneosa soils, 0 to 2 percent slopes, occasionally flooded	980	0.1
MoC	Mobeetie fine sandy loam, 3 to 5 percent slopes	2,551	0.3
MoD	Mobeetie fine sandy loam, 5 to 12 percent slopes	286	*
MVE	Mobeetie-Veal-Potter association, 5 to 20 percent slopes	4,393	0.5
OcA	Olton clay loam, 0 to 1 percent slopes	61,674	6.4
OcB	Olton clay loam, 1 to 3 percent slopes	11,443	1.2
PcA	Pep clay loam, 0 to 1 percent slopes	29,842	3.1
PcB	Pep clay loam, 1 to 3 percent slopes	138,515	14.5
PcC	Pep clay loam, 3 to 5 percent slopes	11,888	1.2
PGE	Potter soils, 3 to 20 percent slopes	2,831	0.3
PMG	Potter-Mobeetie association, 8 to 45 percent slopes	7,207	0.8
PnC	Plemons loam, 3 to 5 percent slopes	17,603	1.8
PrA	Portales clay loam, 0 to 1 percent slopes	5,245	0.5
PuA	Pullman clay loam, 0 to 1 percent slopes	423,536	44.2
PuB	Pullman clay loam, 1 to 3 percent slopes	49,747	5.2
PxA	Pantex silty clay loam, 0 to 1 percent slopes	36,432	3.8
QcB	Quay loam, 1 to 5 percent slopes	12,654	1.3
RaA	Randall clay, 0 to 1 percent slopes, frequently ponded	6,395	0.7
RfC	Redona fine sandy loam, 1 to 5 percent slopes	3,685	0.4
TuA	Tucumcari clay loam, 0 to 1 percent slopes	2,852	0.3
W	Water	268	*
	Total	958,253	100.0

* Less than 0.1 percent.

Table 5.--Irrigated and Nonirrigated Yields by Map Unit Component

(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		Corn		Cotton lint		Grain sorghum		Soybeans		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Bu	Bu	Bu	Bu	Bu	Bu
BcA:												
Bippus	2w	2w	---	190.00	375.00	1,100.00	30.00	120.00	---	50.00	25.00	65.00
BeD:												
Berda	6e	---	---	---	---	---	---	---	---	---	---	---
BfB:												
Berwolf	6c	---	---	---	---	---	20.00	---	---	---	14.00	---
BP:												
Borrow pits	8s	---	---	---	---	---	---	---	---	---	---	---
BpD:												
Berda	6e	---	---	---	---	---	---	---	---	---	---	---
Potter	7s	---	---	---	---	---	---	---	---	---	---	---
BVD:												
Berda	6e	---	---	---	---	---	---	---	---	---	---	---
Veal	6e	---	---	---	---	---	---	---	---	---	---	---
DRC:												
Drake	6e	---	---	---	---	---	25.00	---	---	---	14.00	---
EcA:												
Estacado	3e	2e	---	170.00	350.00	1,000.00	28.00	110.00	---	35.00	18.00	55.00
FrB:												
Friona	3e	3e	---	---	325.00	900.00	22.00	90.00	---	---	16.00	50.00
GQE:												
Glenrio	6e	---	---	---	---	---	---	---	---	---	---	---
Quay	6e	---	---	---	---	---	---	---	---	---	---	---

Table 5.--Irrigated and Nonirrigated Yields by Map Unit Component--Continued

Map symbol and soil name	Land capability		Corn		Cotton lint		Grain sorghum		Soybeans		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Bu	Bu	Bu	Bu	Bu	Bu
IMC:												
Ima-------------	6c	---	---	---	---	---	---	---	---	---	---	---
Lacoca----------	7s	---	---	---	---	---	---	---	---	---	---	---
KmB:												
Kimberson-------	7s	---	---	---	---	---	---	---	---	---	---	---
LcA:												
Lazbuddie-------	3s	2s	---	---	250.00	750.00	30.00	100.00	---	---	18.00	40.00
LoA:												
Lofton----------	3e	2s	---	190.00	250.00	1,050.00	25.00	110.00	---	45.00	18.00	55.00
M-W:												
Water, miscellaneous--	---	---	---	---	---	---	---	---	---	---	---	---
McA:												
McLean----------	4w	4w	---	---	250.00	800.00	25.00	110.00	---	---	18.00	50.00
MNA:												
Minneosa--------	6c	6c	---	---	---	---	---	---	---	---	---	---
MoC:												
Mobeetie--------	4e	4e	---	---	---	---	---	---	---	---	---	---
MoD:												
Mobeetie--------	6e	---	---	---	---	---	---	---	---	---	---	---
MVE:												
Mobeetie--------	6e	---	---	---	---	---	---	---	---	---	---	---
Veal------------	6e	---	---	---	---	---	---	---	---	---	---	---
Potter----------	7s	---	---	---	---	---	---	---	---	---	---	---
OcA:												
Olton-----------	3e	2e	---	190.00	300.00	1,050.00	28.00	110.00	---	45.00	18.00	55.00

Table 5.--Irrigated and Nonirrigated Yields by Map Unit Component--Continued

Map symbol and soil name	Land capability		Corn		Cotton lint		Grain sorghum		Soybeans		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Bu	Bu	Bu	Bu	Bu	Bu
OcB:												
Olton-----------	3e	3e	---	180.00	275.00	900.00	25.00	100.00	---	30.00	15.00	50.00
PcA:												
Pep-------------	3e	2e	---	140.00	250.00	800.00	18.00	60.00	---	25.00	16.00	40.00
PcB:												
Pep-------------	4e	3e	---	130.00	225.00	700.00	16.00	55.00	---	---	14.00	35.00
PcC:												
Pep-------------	6e	4e	---	---	200.00	650.00	14.00	50.00	---	---	12.00	30.00
PGE:												
Potter----------	7s	---	---	---	---	---	---	---	---	---	---	---
PMG:												
Potter----------	7s	---	---	---	---	---	---	---	---	---	---	---
Mobeetie--------	7e	---	---	---	---	---	---	---	---	---	---	---
PnC:												
Plemons---------	4e	---	---	---	---	---	20.00	---	---	---	14.00	---
PrA:												
Portales--------	3e	2e	---	140.00	250.00	800.00	18.00	60.00	---	25.00	16.00	40.00
PuA:												
Pullman---------	3e	2s	---	200.00	325.00	1,100.00	30.00	130.00	---	50.00	25.00	65.00
PuB:												
Pullman---------	3e	3e	---	190.00	300.00	1,000.00	25.00	120.00	---	45.00	20.00	60.00
PxA:												
Pantex----------	3e	2s	---	200.00	325.00	1,100.00	30.00	130.00	---	40.00	30.00	65.00
QcB:												
Quay------------	4e	4e	---	---	---	---	20.00	---	---	---	14.00	---

Table 5.--Irrigated and Nonirrigated Yields by Map Unit Component--Continued

Map symbol and soil name	Land capability		Corn		Cotton lint		Grain sorghum		Soybeans		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Lbs	Lbs	Bu	Bu	Bu	Bu	Bu	Bu
RaA:												
Randall	6w	---	---	---	---	---	---	---	---	---	---	---
RfC:												
Redona	4e	4e	---	---	---	---	20.00	---	---	---	14.00	---
TuA:												
Tucumcari	4s	---	---	---	---	---	20.00	---	---	---	14.00	---
W:												
Water	---	---	---	---	---	---	---	---	---	---	---	---

Table 6.--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: Rating class and limiting features	Value	Application of sewage sludge: Rating class and limiting features	Value
BcA:					
Bippus	85	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
BeD:					
Berda	85	Not limited		Not limited	
BfB:					
Berwolf	85	Very limited		Very limited	
		Filtering capacity	0.99	Filtering capacity	0.99
		Leaching	0.45		
BP:					
Borrow pits	95	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slope	1.00	Slow water movement	1.00
		Slow water movement	1.00	Slope	1.00
		Droughty	0.99	Droughty	0.99
		Runoff	0.40		
BpD:					
Berda	55	Somewhat limited		Somewhat limited	
		Slope	0.01	Slope	0.01
Potter	30	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Slope	0.01	Slope	0.01
BVD:					
Berda	60	Not limited		Not limited	
Veal	25	Not limited		Not limited	
DRC:					
Drake	90	Somewhat limited		Somewhat limited	
		Sodium content	0.32	Sodium content	0.32
EcA:					
Estacado	85	Not limited		Not limited	
FrB:					
Friona	80	Somewhat limited		Very limited	
		Depth to cemented pan	0.38	Low adsorption	1.00
		Droughty	0.32	Depth to cemented pan	0.38
				Droughty	0.32

Table 6.--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: Rating class and limiting features	Value	Application of sewage sludge: Rating class and limiting features	Value
GQE:					
Glenrio	45	Very limited		Very limited	
		Slow water movement	1.00	Droughty	1.00
		Droughty	1.00	Low adsorption	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Runoff	0.40	Slow water movement	1.00
		Slope	0.16	Slope	0.16
Quay	40	Not limited		Not limited	
IMC:					
Ima	50	Not limited		Not limited	
Lacoca	40	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
KmB:					
Kimberson	85	Very limited		Very limited	
		Depth to cemented pan	1.00	Droughty	1.00
		Droughty	1.00	Depth to cemented pan	1.00
		Runoff	0.40	Low adsorption	1.00
LcA:					
Lazbuddie	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40		
LoA:					
Lofton	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40		
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
McA:					
McLean	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Ponding	1.00	Ponding	1.00
		Runoff	0.40		
MNA:					
Minneosa	90	Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00
		Flooding	0.60	Flooding	1.00

Table 6.--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: Rating class and limiting features	Value	Application of sewage sludge: Rating class and limiting features	Value
MoC:					
Mobeetie	85	Not limited		Not limited	
MoD:					
Mobeetie	85	Somewhat limited		Somewhat limited	
		Slope	0.01	Slope	0.01
MVE:					
Mobeetie	50	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Veal	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Potter	15	Somewhat limited		Somewhat limited	
		Slow water movement	0.95	Slow water movement	0.86
		Slope	0.63	Slope	0.63
		Droughty	0.40	Droughty	0.40
OcA:					
Olton	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
OcB:					
Olton	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
PcA:					
Pep	85	Not limited		Not limited	
PcB:					
Pep	85	Not limited		Not limited	
PcC:					
Pep	90	Not limited		Not limited	
PGE:					
Potter	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.95	Slow water movement	0.86
		Droughty	0.40	Droughty	0.40
		Slope	0.01	Slope	0.01
PMG:					
Potter	45	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Slope	1.00	Slope	1.00
Mobeetie	40	Very limited		Very limited	
		Slope	1.00	Slope	1.00

Table 6.--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
PnC:					
Plemons	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
PrA:					
Portales	85	Not limited		Not limited	
PuA:					
Pullman	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
PuB:					
Pullman	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
PxA:					
Pantex	95	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40		
QcB:					
Quay	85	Not limited		Not limited	
RaA:					
Randall	90	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	Too acid	0.14
		Too acid	0.03		
RfC:					
Redona	80	Not limited		Not limited	
TuA:					
Tucumcari	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37
W:					
Water	100	Not rated		Not rated	

Table 7--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: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
BcA:					
Bippus	85	Somewhat limited		Very limited	
		Flooding	0.60	Flooding	1.00
				Seepage	1.00
				Too level	0.50
BeD:					
Berda	85	Somewhat limited		Very limited	
		Too steep for surface application	0.68	Seepage	1.00
BfB:					
Berwolf	85	Very limited		Very limited	
		Filtering capacity	0.99	Seepage	1.00
BP:					
Borrow pits	95	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slow water movement	1.00	Too steep for surface application	1.00
		Too steep for surface application	1.00		
		Too steep for sprinkler application	1.00		
		Droughty	0.99		
BpD:					
Berda	55	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	0.10	Too steep for surface application	0.22
Potter	30	Very limited		Very limited	
		Droughty	1.00	Seepage	1.00
		Too steep for surface application	1.00	Too steep for surface application	0.22
		Too steep for sprinkler application	0.10		

Table 7.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
BVD:					
Berda	60	Somewhat limited		Very limited	
		Too steep for surface application	0.68	Seepage	1.00
Veal	25	Somewhat limited		Very limited	
		Too steep for surface application	0.68	Seepage	1.00
DRC:					
Drake	90	Somewhat limited		Very limited	
		Too steep for surface application	0.32	Seepage	1.00
		Sodium content	0.32	Sodium content	0.32
EcA:					
Estacado	85	Not limited		Very limited	
				Seepage	1.00
				Too level	0.50
FrB:					
Friona	80	Somewhat limited		Very limited	
		Depth to cemented pan	0.38	Depth to cemented pan	1.00
		Droughty	0.32	Seepage	1.00
GQE:					
Glenrio	45	Very limited		Very limited	
		Droughty	1.00	Depth to bedrock	1.00
		Depth to bedrock	1.00	Too steep for surface application	0.78
		Slow water movement	1.00		
		Too steep for surface application	1.00		
		Too steep for sprinkler application	0.40		
Quay	40	Somewhat limited		Very limited	
		Too steep for surface application	0.68	Seepage	1.00
IMC:					
Ima	50	Not limited		Very limited	
				Seepage	1.00

Table 7.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
Lacoca	40	Very limited		Very limited	
		Droughty	1.00	Seepage	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep for surface application	0.32		
KmB:					
Kimberson	85	Very limited		Very limited	
		Droughty	1.00	Depth to cemented pan	1.00
		Depth to cemented pan	1.00	Seepage	1.00
LcA:					
Lazbuddie	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Too level	0.50
LoA:					
Lofton	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Too level	0.68
				Seepage	0.62
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
McA:					
McLean	85	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00
		Ponding	1.00	Too level	0.82
MNA:					
Minneosa	90	Very limited		Very limited	
		Filtering capacity	1.00	Flooding	1.00
		Flooding	0.60	Seepage	1.00
				Too level	0.50
MoC:					
Mobeetie	85	Somewhat limited		Very limited	
		Too steep for surface application	0.08	Seepage	1.00
MoD:					
Mobeetie	85	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	0.10	Too steep for surface application	0.22

Table 7.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
MVE:					
Mobeetie	50	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	1.00	Too steep for surface application	1.00
Veal	25	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	1.00	Too steep for surface application	1.00
Potter	15	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Slow water movement	0.86	Too steep for surface application	1.00
		Too steep for sprinkler application	0.78		
		Droughty	0.40		
OcA:					
Olton	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
				Too level	0.68
OcB:					
Olton	90	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
PcA:					
Pep	85	Not limited		Very limited	
				Seepage	1.00
				Too level	0.50
PcB:					
Pep	85	Not limited		Very limited	
				Seepage	1.00
PcC:					
Pep	90	Somewhat limited		Very limited	
		Too steep for surface application	0.08	Seepage	1.00

Table 7.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
PGE:					
Potter	80	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Slow water movement	0.86	Too steep for surface application	0.22
		Droughty	0.40		
		Too steep for sprinkler application	0.10		
PMG:					
Potter	45	Very limited		Very limited	
		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		
Mobeetie	40	Very limited		Very limited	
		Too steep for surface application	1.00	Seepage	1.00
		Too steep for sprinkler application	1.00	Too steep for surface application	1.00
PnC:					
Plemons	85	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
		Too steep for surface application	0.08		
PrA:					
Portales	85	Not limited		Very limited	
				Seepage	1.00
				Too level	0.50
PuA:					
Pullman	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Too level	0.68
				Seepage	0.62
PuB:					
Pullman	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.62

Table 7.--Agricultural Disposal of Wastewater by Irrigation and Overland Flow--Continued

Map symbol and soil name	Pct. of map unit	Disposal of wastewater by irrigation: Rating class and limiting features	Value	Overland flow of wastewater: Rating class and limiting features	Value
PxA:					
Pantex	95	Very limited		Somewhat limited	
		Slow water movement	1.00	Too level	0.68
				Seepage	0.62
QcB:					
Quay	85	Not limited		Very limited	
				Seepage	1.00
RaA:					
Randall	90	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	Too level	0.82
		Too acid	0.14	Too acid	0.14
RfC:					
Redona	80	Not limited		Very limited	
				Seepage	1.00
TuA:					
Tucumcari	85	Somewhat limited		Very limited	
		Slow water movement	0.37	Seepage	1.00
				Too level	0.68
W:					
Water	100	Not rated		Not rated	

Table 8.--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: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
BcA:					
Bippus	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Flooding	0.60
		Flooding	0.60		
BeD:					
Berda	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.68
		Slope	0.50		
BfB:					
Berwolf	85	Somewhat limited		Very limited	
		Slow water movement	0.31	Filtering capacity	0.99
BP:					
Borrow pits	95	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
				Slow water movement	0.96
BpD:					
Berda	55	Very limited		Very limited	
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	0.22
Potter	30	Very limited		Very limited	
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	0.22

Table 8.--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: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
BVD:					
Berda	60	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.68
		Slope	0.50		
Veal	25	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.68
		Slope	0.50		
DRC:					
Drake	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.32
		Slope	0.12	Sodium content	0.32
EcA:					
Estacado	85	Very limited		Not limited	
		Slow water movement	1.00		
FrB:					
Friona	80	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Slow water movement	1.00		
GQE:					
Glenrio	45	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	Slow water movement	0.96
				Too steep for sprinkler irrigation	0.78
Quay	40	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.68
		Slope	0.50		
IMC:					
Ima	50	Somewhat limited		Not limited	
		Slow water movement	0.32		

Table 8.--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: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
Lacoca--------------	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slow water movement	0.32	Too steep for surface application	0.32
		Slope	0.12		
KmB:					
Kimberson-----------	85	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Slow water movement	1.00		
LcA:					
Lazbuddie-----------	90	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
LoA:					
Lofton--------------	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
McA:					
McLean--------------	85	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slow water movement	1.00	Slow water movement	1.00
MNA:					
Minneosa------------	90	Somewhat limited		Very limited	
		Flooding	0.60	Filtering capacity	1.00
		Slow water movement	0.31	Flooding	0.60
MoC:					
Mobeetie------------	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.32	Too steep for surface application	0.08
MoD:					
Mobeetie------------	85	Very limited		Very limited	
		Slope	1.00	Too steep for surface application	1.00
		Slow water movement	0.32	Too steep for sprinkler irrigation	0.22

Table 8.--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: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
MVE:					
Mobeetie	50	Very limited		Very limited	
		Slope	1.00	Too steep for surface application	1.00
		Slow water movement	0.32	Too steep for sprinkler irrigation	1.00
Veal	25	Very limited		Very limited	
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
Potter	15	Very limited		Very limited	
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Too steep for sprinkler irrigation	1.00
				Slow water movement	0.70
OcA:					
Olton	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
OcB:					
Olton	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
PcA:					
Pep	85	Very limited		Not limited	
		Slow water movement	1.00		
PcB:					
Pep	85	Very limited		Not limited	
		Slow water movement	1.00		
PcC:					
Pep	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Too steep for surface application	0.08

Table 8.--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
PGE:					
Potter	80	Very limited		Very limited	
		Slow water movement	1.00	Too steep for surface application	1.00
		Slope	1.00	Slow water movement	0.70
				Too steep for sprinkler irrigation	0.22
PMG:					
Potter	45	Very limited		Very limited	
		Slope	1.00	Too steep for surface application	1.00
		Slow water movement	1.00	Too steep for sprinkler irrigation	1.00
Mobeetie	40	Very limited		Very limited	
		Slope	1.00	Too steep for surface application	1.00
		Slow water movement	0.32	Too steep for sprinkler irrigation	1.00
PnC:					
Plemons	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94
				Too steep for surface application	0.08
PrA:					
Portales	85	Very limited		Not limited	
		Slow water movement	1.00		
PuA:					
Pullman	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94
PuB:					
Pullman	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94
PxA:					
Pantex	95	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.94

Table 8.--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: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
QcB:					
Quay	85	Very limited		Not limited	
		Slow water movement	1.00		
RaA:					
Randall	90	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
				Too acid	0.14
RfC:					
Redona	80	Very limited		Not limited	
		Slow water movement	1.00		
TuA:					
Tucumcari	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slow water movement	0.26
W:					
Water	100	Not rated		Not rated	

Table 9.--Large Animal 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	Animal Disposal Pit: Rating class and limiting features	Value	Animal Disposal Trench: Rating class and limiting features	Value
BcA:					
Bippus	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Water gathering	0.20	Water gathering	0.20
		Cutbanks cave	0.01	Cutbanks cave	0.01
BeD:					
Berda	85	Somewhat limited		Somewhat limited	
		Water gathering	0.10	Water gathering	0.10
		Slope	0.04	Cutbanks cave	0.01
		Cutbanks cave	0.01	Clay content	0.01
BfB:					
Berwolf	85	Somewhat limited		Somewhat limited	
		Water gathering	0.07	Water gathering	0.07
		Cutbanks cave	0.01	Cutbanks cave	0.01
BP:					
Borrow pits	95	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slope	1.00	Slope	1.00
		Cutbanks cave	0.09	Cutbanks cave	0.09
BpD:					
Berda	55	Somewhat limited		Somewhat limited	
		Slope	0.37	Water gathering	0.10
		Water gathering	0.10	Cutbanks cave	0.01
		Cutbanks cave	0.01	Clay content	0.01
Potter	30	Somewhat limited		Somewhat limited	
		Slope	0.37	Cutbanks cave	0.31
		Cutbanks cave	0.31	Water gathering	0.03
		Water gathering	0.03	Slope	0.01
BVD:					
Berda	60	Somewhat limited		Somewhat limited	
		Water gathering	0.10	Water gathering	0.10
		Slope	0.04	Cutbanks cave	0.01
		Cutbanks cave	0.01	Clay content	0.01
Veal	25	Somewhat limited		Somewhat limited	
		Water gathering	0.10	Water gathering	0.10
		Slope	0.04	Cutbanks cave	0.01
		Cutbanks cave	0.01		
DRC:					
Drake	90	Somewhat limited		Somewhat limited	
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01

Table 9.--Large Animal Disposal--Continued

Map symbol and soil name	Pct. of map unit	Animal Disposal Pit: Rating class and limiting features	Animal Disposal Pit: Value	Animal Disposal Trench: Rating class and limiting features	Animal Disposal Trench: Value
EcA:					
Estacado	85	Somewhat limited		Somewhat limited	
		Clay content	0.18	Clay content	0.18
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
FrB:					
Friona	80	Somewhat limited		Somewhat limited	
		Depth to thin cemented pan	0.50	Depth to thin cemented pan	0.50
		Adsorption	0.25	Adsorption	0.25
		Water gathering	0.10	Water gathering	0.10
GQE:					
Glenrio	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.84	Cutbanks cave	0.51
		Cutbanks cave	0.51	Adsorption	0.25
Quay	40	Somewhat limited		Somewhat limited	
		Slope	0.04	Cutbanks cave	0.01
		Cutbanks cave	0.01		
IMC:					
Ima	50	Somewhat limited		Somewhat limited	
		Water gathering	0.03	Water gathering	0.03
		Cutbanks cave	0.01	Cutbanks cave	0.01
Lacoca	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Adsorption	0.25	Adsorption	0.25
		Cutbanks cave	0.05	Cutbanks cave	0.05
KmB:					
Kimberson	85	Somewhat limited		Somewhat limited	
		Cutbanks cave	0.93	Cutbanks cave	0.93
		Depth to thin cemented pan	0.50	Depth to thin cemented pan	0.50
		Adsorption	0.25	Adsorption	0.25
LcA:					
Lazbuddie	90	Very limited		Very limited	
		Cutbanks cave	1.00	Cutbanks cave	1.00
		Clay content	0.50	Clay content	0.50
		Water gathering	0.20	Water gathering	0.20
LoA:					
Lofton	85	Somewhat limited		Somewhat limited	
		Clay content	0.44	Clay content	0.44
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
M-W:					
Water, miscellaneous	100	Not rated		Not rated	

Table 9.--Large Animal Disposal--Continued

Map symbol and soil name	Pct. of map unit	Animal Disposal Pit		Animal Disposal Trench	
		Rating class and limiting features	Value	Rating class and limiting features	Value
McA:					
McLean	85	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Cutbanks cave	1.00	Cutbanks cave	1.00
		Clay content	0.50	Clay content	0.50
MNA:					
Minneosa	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Too sandy	1.00	Too sandy	1.00
		Cutbanks cave	0.29	Cutbanks cave	0.29
MoC:					
Mobeetie	85	Somewhat limited		Somewhat limited	
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
MoD:					
Mobeetie	85	Somewhat limited		Somewhat limited	
		Slope	0.37	Water gathering	0.10
		Water gathering	0.10	Cutbanks cave	0.01
		Cutbanks cave	0.01	Slope	0.01
MVE:					
Mobeetie	50	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
Veal	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
Potter	15	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.63
		Cutbanks cave	0.31	Cutbanks cave	0.31
		Water gathering	0.03	Water gathering	0.03
OcA:					
Olton	85	Somewhat limited		Somewhat limited	
		Clay content	0.20	Clay content	0.20
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
OcB:					
Olton	90	Somewhat limited		Somewhat limited	
		Clay content	0.20	Clay content	0.20
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
PcA:					
Pep	85	Somewhat limited		Somewhat limited	
		Clay content	0.11	Clay content	0.11
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01

Table 9.--Large Animal Disposal--Continued

Map symbol and soil name	Pct. of map unit	Animal Disposal Pit		Animal Disposal Trench	
		Rating class and limiting features	Value	Rating class and limiting features	Value
PcB:					
Pep	85	Somewhat limited		Somewhat limited	
		Clay content	0.12	Clay content	0.12
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
PcC:					
Pep	90	Somewhat limited		Somewhat limited	
		Water gathering	0.20	Water gathering	0.20
		Clay content	0.12	Clay content	0.12
		Cutbanks cave	0.01	Cutbanks cave	0.01
PGE:					
Potter	80	Somewhat limited		Somewhat limited	
		Slope	0.37	Cutbanks cave	0.31
		Cutbanks cave	0.31	Water gathering	0.03
		Water gathering	0.03	Slope	0.01
PMG:					
Potter	45	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Cutbanks cave	0.31	Cutbanks cave	0.31
		Water gathering	0.03	Water gathering	0.03
Mobeetie	40	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Water gathering	0.20	Water gathering	0.20
		Cutbanks cave	0.01	Cutbanks cave	0.01
PnC:					
Plemons	85	Somewhat limited		Somewhat limited	
		Clay content	0.13	Clay content	0.13
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
PrA:					
Portales	85	Somewhat limited		Somewhat limited	
		Water gathering	0.20	Water gathering	0.20
		Clay content	0.01	Clay content	0.01
		Cutbanks cave	0.01	Cutbanks cave	0.01
PuA:					
Pullman	90	Somewhat limited		Somewhat limited	
		Clay content	0.46	Clay content	0.46
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01
PuB:					
Pullman	90	Somewhat limited		Somewhat limited	
		Clay content	0.46	Clay content	0.46
		Water gathering	0.10	Water gathering	0.10
		Cutbanks cave	0.01	Cutbanks cave	0.01

Table 9.--Large Animal Disposal--Continued

Map symbol and soil name	Pct. of map unit	Animal Disposal Pit: Rating class and limiting features	Animal Disposal Pit: Value	Animal Disposal Trench: Rating class and limiting features	Animal Disposal Trench: Value
PxA:					
Pantex	95	Somewhat limited		Somewhat limited	
		Cutbanks cave	0.64	Cutbanks cave	0.64
		Clay content	0.39	Clay content	0.39
		Water gathering	0.10	Water gathering	0.10
QcB:					
Quay	85	Somewhat limited		Somewhat limited	
		Cutbanks cave	0.01	Cutbanks cave	0.01
RaA:					
Randall	90	Very limited		Very limited	
		Wetness	1.00	Wetness	1.00
		Ponding	1.00	Ponding	1.00
		Too clayey	1.00	Too clayey	1.00
RfC:					
Redona	80	Somewhat limited		Somewhat limited	
		Water gathering	0.03	Water gathering	0.03
		Cutbanks cave	0.01	Cutbanks cave	0.01
TuA:					
Tucumcari	85	Somewhat limited		Somewhat limited	
		Clay content	0.06	Clay content	0.06
		Water gathering	0.03	Water gathering	0.03
		Cutbanks cave	0.01	Cutbanks cave	0.01
W:					
Water	100	Not rated		Not rated	

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
BcA:				
Bippus	Draw Pe 25-36	3,000	2,400	1,800
BeD:				
Berda	Hardland Slopes Pe 25 - 36	2,500	1,800	1,100
BfB:				
Berwolf	Sandy Plains	2,500	1,800	1,100
BP:				
Borrow pits	---	---	---	---
BpD:				
Berda	Hardland Slopes Pe 25 - 36	2,500	1,800	1,100
Potter	Very Shallow Pe 25-36	1,000	800	500
BVD:				
Berda	Hardland Slopes Pe 25 - 36	2,500	1,800	1,100
Veal	Limy Upland Pe 25-36	2,100	1,600	1,000
DRC:				
Drake	High Lime Pe 25 - 36	1,800	1,300	900
EcA:				
Estacado	Deep Hardland Pe 25-36	2,300	1,600	1,000
FrB:				
Friona	Deep Hardland Pe 25-36	2,100	1,600	1,000
GQE:				
Glenrio	Red Shale Pe 25-31	1,000	750	500
Quay	Loamy Pe 25-31	1,600	1,100	800
IMC:				
Ima	Sandy Plains	1,600	1,100	700
Lacoca	Shale Sandstone Pe 25-31	1,000	700	400
KmB:				
Kimberson	Very Shallow Pe 25-36	1,000	700	400
LcA:				
Lazbuddie	Deep Hardland Pe 25-36	2,400	1,200	500
LoA:				
Lofton	Deep Hardland Pe 25-36	2,000	1,800	1,100
M-W:				
Water, miscellaneous	---	---	---	---
McA:				
McLean	Playa Pe 25-36	2,800	1,300	600

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
MNA:				
Minneosa	Bottomland Pe 25-31	1,800	1,300	900
MoC:				
Mobeetie	Mixedland Slopes Pe 25-36	2,500	2,000	1,100
MoD:				
Mobeetie	Mixedland Slopes Pe 25-36	2,500	2,000	1,100
MVE:				
Mobeetie	Mixedland Slopes Pe 25-36	2,500	1,900	1,100
Veal	Limy Upland Pe 25-36	2,100	1,600	1,000
Potter	Very Shallow Pe 25-36	1,000	800	500
OcA:				
Olton	Deep Hardland Pe 25-36	2,300	1,600	900
OcB:				
Olton	Deep Hardland Pe 25-36	2,000	1,500	1,000
PcA:				
Pep	Limy Upland Pe 25-36	2,000	1,300	800
PcB:				
Pep	Limy Upland Pe 25-36	2,000	1,300	800
PcC:				
Pep	Limy Upland Pe 25-36	2,000	1,300	800
PGE:				
Potter	Very Shallow Pe 25-36	1,000	800	500
PMG:				
Potter	Very Shallow Pe 25-36	1,000	800	500
Mobeetie	Mixedland Slopes Pe 25-36	2,500	2,000	1,100
PnC:				
Plemons	Limy Upland Pe 25-36	2,500	1,800	1,100
PrA:				
Portales	Limy Upland Pe 25-36	2,000	1,300	800
PuA:				
Pullman	Deep Hardland Pe 25-36	2,300	1,600	900
PuB:				
Pullman	Deep Hardland Pe 25-36	2,300	1,600	900
PxA:				
Pantex	Deep Hardland Pe 25-36	2,400	1,700	1,000
QcB:				
Quay	Loamy Pe 25-31	1,600	1,100	800
RaA:				
Randall	Playa Pe 25-36	3,000	1,500	800

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
RfC:				
Redona	Sandy Loam Pe 25-31	2,400	1,700	1,000
TuA:				
Tucumcari	Clayey Pe 25-31	1,800	1,300	800
W:				
Water	---	---	---	---

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
BcA:					
Bippus	honeysuckle; Nanking cherry; skunkbush sumac; cotoneaster	redbud; desert willow; winterberry euonymus	little walnut; Rocky Mountain juniper; eastern redcedar; osageorange; Austrian pine; Scotch pine; oriental arborvitae	American sycamore; pecan; hackberry; green ash; honeylocust; mulberry; ponderosa pine; bur oak; shumard oak; lacebark elm; Afghan pine	Siberian elm
BeD:					
Berda	fourwing saltbush	---	eastern redcedar	Siberian elm	---
BfB:					
Berwolf	skunkbush sumac; lilac; honeysuckle	desert willow; redbud; Chickasaw plum	Rocky Mountain juniper; eastern redcedar; oriental arborvitae; osageorange	Austrian pine; ponderosa pine; bur oak; green ash; hackberry; honeylocust; mulberry; lacebark elm	Siberian elm
BP:					
Borrow pits	---	---	---	---	---
BpD:					
Berda	fourwing saltbush	---	eastern redcedar	Siberian elm	---
Potter	---	---	---	---	---
BVD:					
Berda	fourwing saltbush	---	eastern redcedar	Siberian elm	---
Veal	fourwing saltbush	---	eastern redcedar	Siberian elm	---
DRC:					
Drake	fourwing saltbush	---	eastern redcedar	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
EcA:					
Estacado	honeysuckle; Nanking cherry; skunkbush sumac; cotoneaster	redbud; desert willow; winterberry euonymus	little walnut; Rocky Mountain juniper; eastern redcedar; osageorange; Austrian pine; Scotch pine; oriental arborvitae	American sycamore; pecan; hackberry; green ash; honeylocust; mulberry; ponderosa pine; bur oak; shumard oak; lacebark elm; Afghan pine	Siberian elm
FrB:					
Friona	skunkbush sumac; fourwing saltbush	Rocky Mountain juniper; redbud; desert willow	eastern redcedar; lacebark elm; osageorange; oriental arborvitae; hackberry	Siberian elm	---
GQE:					
Glenrio	---	---	---	---	---
Quay	fourwing saltbush	---	eastern redcedar	Siberian elm	---
IMC:					
Ima	skunkbush sumac; lilac; honeysuckle	desert willow; redbud; Chickasaw plum	Rocky Mountain juniper; eastern redcedar; oriental arborvitae; osageorange	Austrian pine; ponderosa pine; bur oak; green ash; hackberry; honeylocust; mulberry; lacebark elm	Siberian elm
Lacoca	---	---	---	---	---
KmB:					
Kimberson	---	---	---	---	---
LcA:					
Lazbuddie	---	---	---	---	---

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
LoA:					
Lofton	skunkbush sumac; Nanking cherry; lilac	Rocky Mountain juniper; redbud	eastern redcedar; oriental arborvitae; osageorange	ponderosa pine; bur oak; Siberian elm; hackberry; lacebark elm	---
M-W:					
Water, miscellaneous	---	---	---	---	---
McA:					
McLean	---	---	---	---	---
MNA:					
Minneosa	Nanking cherry; twoneedle pinyon; western sandcherry	---	---	---	---
MoC:					
Mobeetie	fourwing saltbush	---	eastern redcedar	Siberian elm	---
MoD:					
Mobeetie	fourwing saltbush	---	eastern redcedar	Siberian elm	---
MVE:					
Mobeetie	fourwing saltbush	---	eastern redcedar	Siberian elm	---
Veal	fourwing saltbush	---	eastern redcedar	Siberian elm	---
Potter	---	---	---	---	---
OcA:					
Olton	honeysuckle; Nanking cherry; skunkbush sumac; cotoneaster	redbud; desert willow; winterberry euonymus	little walnut; Rocky Mountain juniper; eastern redcedar; osageorange; Austrian pine; Scotch pine; oriental arborvitae	American sycamore; pecan; hackberry; green ash; honeylocust; mulberry; ponderosa pine; bur oak; shumard oak; lacebark elm; Afghan 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
OcB:					
Olton	honeysuckle; Nanking cherry; skunkbush sumac; cotoneaster	redbud; desert willow; winterberry euonymus	little walnut; Rocky Mountain juniper; eastern redcedar; osageorange; Austrian pine; Scotch pine; oriental arborvitae	American sycamore; pecan; hackberry; green ash; honeylocust; mulberry; ponderosa pine; bur oak; shumard oak; lacebark elm; Afghan pine	Siberian elm
PcA:					
Pep	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PcB:					
Pep	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PcC:					
Pep	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PGE:					
Potter	---	---	---	---	---
PMG:					
Potter	---	---	---	---	---
Mobeetie	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PnC:					
Plemons	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PrA:					
Portales	fourwing saltbush	---	eastern redcedar	Siberian elm	---
PuA:					
Pullman	skunkbush sumac; Nanking cherry; lilac	Rocky Mountain juniper; redbud	eastern redcedar; oriental arborvitae; osageorange	ponderosa pine; bur oak; Siberian elm; hackberry	---

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
PuB: Pullman	skunkbush sumac; Nanking cherry; lilac	Rocky Mountain juniper; redbud	eastern redcedar; oriental arborvitae; osageorange	ponderosa pine; bur oak; Siberian elm; hackberry	---
PxA: Pantex	skunkbush sumac; Nanking cherry; lilac	Rocky Mountain juniper; redbud	eastern redcedar; oriental arborvitae; osageorange	ponderosa pine; bur oak; Siberian elm; hackberry	---
QcB: Quay	fourwing saltbush	---	eastern redcedar	Siberian elm	---
RaA: Randall	---	---	---	---	---
RfC: Redona	skunkbush sumac; lilac; honeysuckle	desert willow; redbud; Chickasaw plum	Rocky Mountain juniper; eastern redcedar; oriental arborvitae; osageorange	Austrian pine; ponderosa pine; bur oak; green ash; hackberry; honeylocust; mulberry; lacebark elm	Siberian elm
TuA: Tucumcari	honeysuckle; Nanking cherry; skunkbush sumac	redbud; desert willow	little walnut; Rocky Mountain juniper; eastern redcedar; osageorange; Austrian pine; Scotch pine; oriental arborvitae	American sycamore; pecan; hackberry; green ash; honeylocust; mulberry; ponderosa pine; bur oak; shumard oak; lacebark elm	Siberian elm
W: Water	---	---	---	---	---

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: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value	Playgrounds: Rating class and limiting features	Playgrounds: Value
BcA:							
Bippus	85	Very limited		Not limited		Somewhat limited	
		Flooding	1.00			Flooding	0.60
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
						Dusty	0.50
BfB:							
Berwolf	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.44	Too sandy	0.44	Too sandy	0.44
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Slope	1.00	Slope	1.00	Gravel content	1.00
		Gravel content	1.00	Gravel content	1.00	Slope	1.00
		Slow water movement	0.96	Slow water movement	0.96	Slow water movement	0.96
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
		Slope	0.01	Slope	0.01	Dusty	0.50
Potter	30	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
		Slope	0.01	Slope	0.01	Gravel content	0.92
						Dusty	0.50
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
						Dusty	0.50
Veal	25	Not limited		Not limited		Very limited	
						Slope	1.00
DRC:							
Drake	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Slope	0.88
						Dusty	0.50
EcA:							
Estacado	85	Not limited		Not limited		Not limited	
FrB:							
Friona	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
		Depth to cemented pan	0.39	Depth to cemented pan	0.39		

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value	Playgrounds: Rating class and limiting features	Playgrounds: Value
GQE:							
Glenrio	45	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	0.41	Slow water movement	0.41	Too clayey	0.50
		Slope	0.16	Slope	0.16	Slow water movement	0.41
Quay	40	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
						Dusty	0.50
IMC:							
Ima	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.52	Too sandy	0.52	Too sandy	0.52
						Slope	0.12
Lacoca	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Too sandy	0.52	Too sandy	0.52	Slope	0.88
						Too sandy	0.52
KmB:							
Kimberson	85	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00	Depth to cemented pan	1.00
						Gravel content	0.94
LcA:							
Lazbuddie	90	Somewhat limited		Somewhat limited		Somewhat limited	
		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
LoA:							
Lofton	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	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
MNA:							
Minneosa	90	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.76	Too sandy	0.76
		Too sandy	0.76			Flooding	0.60

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
MoC:							
Mobeetie	85	Not limited		Not limited		Somewhat limited	
						Slope	0.50
MoD:							
Mobeetie	85	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
MVE:							
Mobeetie	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Veal	25	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Potter	15	Somewhat limited		Somewhat limited		Very limited	
		Slow water movement	0.70	Slow water movement	0.70	Slope	1.00
		Slope	0.63	Slope	0.63	Gravel content	0.92
		Dusty	0.50	Dusty	0.50	Slow water movement	0.70
						Dusty	0.50
OcA:							
Olton	85	Not limited		Not limited		Not limited	
OcB:							
Olton	90	Not limited		Not limited		Not limited	
PcA:							
Pep	85	Not limited		Not limited		Not limited	
PcB:							
Pep	85	Not limited		Not limited		Not limited	
PcC:							
Pep	90	Not limited		Not limited		Somewhat limited	
						Slope	0.50
PGE:							
Potter	80	Somewhat limited		Somewhat limited		Very limited	
		Slow water movement	0.70	Slow water movement	0.70	Slope	1.00
		Dusty	0.50	Dusty	0.50	Gravel content	0.92
		Slope	0.01	Slope	0.01	Slow water movement	0.70
						Dusty	0.50
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50	Gravel content	0.92
						Dusty	0.50
Mobeetie	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00

Table 12.--Camp Areas, Picnic Areas, and Playgrounds--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value	Playgrounds: Rating class and limiting features	Playgrounds: Value
PnC:							
Plemons	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Slope	0.50
						Dusty	0.50
PrA:							
Portales	85	Not limited		Not limited		Not limited	
PuA:							
Pullman	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
PuB:							
Pullman	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
PxA:							
Pantex	95	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39	Slow water movement	0.39
QcB:							
Quay	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
						Slope	0.12
RaA:							
Randall	90	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
RfC:							
Redona	80	Not limited		Not limited		Somewhat limited	
						Slope	0.12
TuA:							
Tucumcari	85	Not limited		Not limited		Not limited	
W:							
Water	100	Not rated		Not rated		Not rated	

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: Rating class and limiting features	Value	Off-road motorcycle trails: Rating class and limiting features	Value	Golf course fairways: Rating class and limiting features	Value
BcA:							
Bippus	85	Not limited		Not limited		Somewhat limited	
						Flooding	0.60
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
BfB:							
Berwolf	85	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.44	Too sandy	0.44		
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Gravel content	1.00	Gravel content	1.00	Droughty	1.00
		Slope	0.92			Slope	1.00
						Gravel content	1.00
						Carbonate content	1.00
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Slope	0.01
Potter	30	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Carbonate content	1.00
						Droughty	0.99
						Slope	0.01
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
Veal	25	Not limited		Not limited		Very limited	
						Carbonate content	1.00
DRC:							
Drake	90	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
EcA:							
Estacado	85	Not limited		Not limited		Not limited	
FrB:							
Friona	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Depth to cemented pan	0.38

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
GQE:							
Glenrio	45	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Depth to bedrock	1.00
						Too clayey	1.00
						Droughty	0.99
						Slope	0.16
Quay	40	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
IMC:							
Ima	50	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.52	Too sandy	0.52		
Lacoca	40	Somewhat limited		Somewhat limited		Very limited	
		Too sandy	0.52	Too sandy	0.52	Depth to bedrock	1.00
						Droughty	1.00
KmB:							
Kimberson	85	Not limited		Not limited		Very limited	
						Depth to cemented pan	1.00
						Carbonate content	1.00
						Droughty	1.00
LcA:							
Lazbuddie	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Too clayey	1.00
LoA:							
Lofton	85	Not limited		Not limited		Not limited	
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Too clayey	1.00
		Too clayey	0.50	Too clayey	0.50	Ponding	1.00
MNA:							
Minneosa	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76	Flooding	0.60
						Droughty	0.01
MoC:							
Mobeetie	85	Not limited		Not limited		Not limited	
MoD:							
Mobeetie	85	Not limited		Not limited		Somewhat limited	
						Slope	0.01
MVE:							
Mobeetie	50	Not limited		Not limited		Very limited	
						Slope	1.00

Table 13.--Paths, Trails, and Golf Course Fairways--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails: Rating class and limiting features	Paths and trails: Value	Off-road motorcycle trails: Rating class and limiting features	Off-road motorcycle trails: Value	Golf course fairways: Rating class and limiting features	Golf course fairways: Value
Veal	25	Not limited		Not limited		Very limited	
						Slope	1.00
						Carbonate content	1.00
Potter	15	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Carbonate content	1.00
						Slope	0.63
						Droughty	0.51
OcA:							
Olton	85	Not limited		Not limited		Not limited	
OcB:							
Olton	90	Not limited		Not limited		Not limited	
PcA:							
Pep	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PcB:							
Pep	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PcC:							
Pep	90	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PGE:							
Potter	80	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Carbonate content	1.00
						Droughty	0.51
						Slope	0.01
PMG:							
Potter	45	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
		Slope	0.18			Carbonate content	1.00
						Droughty	0.99
Mobeetie	40	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Slope	0.08	Slope	1.00
PnC:							
Plemons	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
PrA:							
Portales	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PuA:							
Pullman	90	Not limited		Not limited		Not limited	
PuB:							
Pullman	90	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: Rating class and limiting features	Value	Off-road motorcycle trails: Rating class and limiting features	Value	Golf course fairways: Rating class and limiting features	Value
PxA:							
Pantex	95	Not limited		Not limited		Not limited	
QcB:							
Quay	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
RaA:							
Randall	90	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too clayey	1.00
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Too clayey	0.50	Too clayey	0.50	Depth to saturated zone	1.00
RfC:							
Redona	80	Not limited		Not limited		Not limited	
TuA:							
Tucumcari	85	Not limited		Not limited		Not limited	
W:							
Water	100	Not rated		Not rated		Not rated	

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat

(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	Grain and seed crops for food and cover: Rating class and limiting features	Grain and seed crops for food and cover: Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Domestic grasses and legumes for food and cover: Value
BcA:					
Bippus	85	Somewhat limited		Somewhat limited	
		Flooding	0.50	Flooding	0.50
		Too clayey	0.02	Too clayey	0.02
BeD:					
Berda	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too arid	0.50
		Too arid	0.50		
		Droughty	0.18		
BfB:					
Berwolf	85	Very limited		Very limited	
		HEL wind	1.00	Too arid	1.00
		Too arid	1.00	Too sandy	0.50
		Droughty	0.76		
		Too sandy	0.50		
BP:					
Borrow pits	95	Not rated		Not rated	
BpD:					
Berda	55	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Too arid	0.50		
		Droughty	0.18		
Potter	30	Very limited		Very limited	
		Droughty	1.00	Potentially or highly erodible	1.00
		HEL wind	1.00	Too arid	1.00
		Potentially or highly erodible	1.00	Droughty	0.99
		Too arid	1.00		
BVD:					
Berda	60	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Too arid	0.50		
		Droughty	0.18		

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Grain and seed crops for food and cover: Rating class and limiting features	Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Value
Veal	25	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Droughty	0.79		
		Too arid	0.50		
DRC:					
Drake	90	Very limited		Somewhat limited	
		HEL wind	1.00	Too arid	0.50
		Droughty	0.58		
		Too arid	0.50		
EcA:					
Estacado	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too clayey	0.57
		Too clayey	0.57	Too arid	0.50
		Too arid	0.50		
FrB:					
Friona	80	Very limited		Somewhat limited	
		HEL wind	1.00	Cemented pan	0.39
		Droughty	0.69		
		Cemented pan	0.39		
GQE:					
Glenrio	45	Very limited		Very limited	
		Droughty	1.00	Potentially or highly erodible	1.00
		HEL wind	1.00	Bedrock	1.00
		Bedrock	1.00	Too clayey	1.00
		Too clayey	1.00	Too arid	1.00
		Potentially or highly erodible	1.00	Droughty	0.99
Quay	40	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	1.00
		Too arid	1.00		
IMC:					
Ima	50	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	1.00
		Too arid	1.00	Too sandy	0.50
		Droughty	0.58		
		Too sandy	0.50		

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Grain and seed crops for food and cover: Rating class and limiting features	Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Value
Lacoca--------------	40	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		HEL wind	1.00	Potentially or highly erodible	1.00
		Bedrock	1.00	Bedrock	1.00
		Potentially or highly erodible	1.00	Too arid	1.00
		Too arid	1.00	Too sandy	0.50
KmB:					
Kimberson-----------	85	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		HEL wind	1.00	Cemented pan	1.00
		Cemented pan	1.00	Too gravelly, cobbly, or stony	0.01
		Too gravelly, cobbly, or stony	0.01		
LcA:					
Lazbuddie-----------	90	Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00
		Percs slowly	0.50	Percs slowly	0.50
LoA:					
Lofton--------------	85	Very limited		Very limited	
		Percs slowly	1.00	Percs slowly	1.00
		Too clayey	0.70	Too clayey	0.70
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
McA:					
McLean--------------	85	Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00
		Ponding	0.50	Ponding	0.50
		Percs slowly	0.50	Percs slowly	0.50
MNA:					
Minneosa------------	90	Very limited		Very limited	
		HEL wind	1.00	Too arid	1.00
		Too arid	1.00	Too sandy	0.50
		Droughty	0.99	Flooding	0.50
		Flooding	0.50		
		Too sandy	0.50		
MoC:					
Mobeetie------------	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too arid	0.50
		Droughty	0.91		
		Too arid	0.50		

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Grain and seed crops for food and cover: Rating class and limiting features	Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Value
MoD:					
Mobeetie	85	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Droughty	0.93		
		Too arid	0.50		
MVE:					
Mobeetie	50	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Droughty	0.91		
		Too arid	0.50		
Veal	25	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	0.50
		Droughty	0.79		
		Too arid	0.50		
Potter	15	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Too arid	1.00
		Too arid	1.00	Droughty	0.49
		Droughty	1.00		
OcA:					
Olton	85	Somewhat limited		Somewhat limited	
		Too arid	0.50	Too arid	0.50
		Too clayey	0.05	Too clayey	0.05
OcB:					
Olton	90	Somewhat limited		Somewhat limited	
		Too arid	0.50	Too arid	0.50
		Too clayey	0.05	Too clayey	0.05
PcA:					
Pep	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too clayey	0.57
		Too clayey	0.57	Too arid	0.50
		Too arid	0.50		
		Droughty	0.06		
PcB:					
Pep	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too clayey	0.57
		Too clayey	0.57	Too arid	0.50
		Too arid	0.50		
		Droughty	0.07		

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Grain and seed crops for food and cover: Rating class and limiting features	Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Value
PcC:					
Pep	90	Very limited		Somewhat limited	
		HEL wind	1.00	Too clayey	0.57
		Too clayey	0.57	Too arid	0.50
		Too arid	0.50		
		Droughty	0.09		
PGE:					
Potter	80	Very limited		Very limited	
		Potentially or highly erodible	1.00	Potentially or highly erodible	1.00
		Too arid	1.00	Too arid	1.00
		Droughty	1.00	Droughty	0.49
PMG:					
Potter	45	Very limited		Very limited	
		Droughty	1.00	Potentially or highly erodible	1.00
		HEL wind	1.00	Too arid	1.00
		Potentially or highly erodible	1.00	Droughty	0.99
		Too arid	1.00	Slope	0.08
		Slope	0.08		
Mobeetie	40	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00	Slope	0.96
		Slope	0.96	Too arid	0.50
		Droughty	0.91		
		Too arid	0.50		
PnC:					
Plemons	85	Very limited		Very limited	
		HEL wind	1.00	Potentially or highly erodible	1.00
		Potentially or highly erodible	1.00		
		Droughty	0.04		
PrA:					
Portales	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too arid	0.50
		Too arid	0.50	Too clayey	0.43
		Too clayey	0.43		
		Droughty	0.02		
PuA:					
Pullman	90	Somewhat limited		Somewhat limited	
		Too clayey	0.50	Too clayey	0.50
		Too arid	0.50	Too arid	0.50
		Percs slowly	0.33	Percs slowly	0.33

Table 14.--Grain and Seed Crops and Domestic Grasses and Legumes for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Grain and seed crops for food and cover: Rating class and limiting features	Value	Domestic grasses and legumes for food and cover: Rating class and limiting features	Value
PuB:					
Pullman	90	Somewhat limited		Somewhat limited	
		Too clayey	0.50	Too clayey	0.50
		Too arid	0.50	Too arid	0.50
		Percs slowly	0.33	Percs slowly	0.33
PxA:					
Pantex	95	Somewhat limited		Somewhat limited	
		Too clayey	0.56	Too clayey	0.56
		Too arid	0.50	Too arid	0.50
		Percs slowly	0.33	Percs slowly	0.33
QcB:					
Quay	85	Very limited		Very limited	
		HEL wind	1.00	Too arid	1.00
		Too arid	1.00		
RaA:					
Randall	90	Very limited		Very limited	
		Wetness	1.00	Wetness	1.00
		Too clayey	1.00	Too clayey	1.00
		Ponding	1.00	Ponding	1.00
		Percs slowly	0.50	Percs slowly	0.50
RfC:					
Redona	80	Very limited		Very limited	
		HEL wind	1.00	Too arid	1.00
		Too arid	1.00		
		Droughty	0.13		
TuA:					
Tucumcari	85	Very limited		Somewhat limited	
		HEL wind	1.00	Too clayey	0.19
		Too clayey	0.19		
W:					
Water	100	Not rated		Not rated	

Table 15.--Upland Wild Herbaceous Plants, Upland Shrubs and Vines, and Freshwater Wetland Plants for Wildlife Habitat

(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	Upland wild herbaceous plants		Upland shrubs and vines		Freshwater Wetland plants	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BcA:							
Bippus	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.02	Too clayey	0.02	Too dry	1.00
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
BfB:							
Berwolf	85	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Too sandy	0.50				
BP:							
Borrow pits	95	Not rated		Not rated		Very limited	
						Too dry	1.00
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
Potter	30	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Droughty	0.99	Droughty	0.99	Too alkaline	1.00
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
Veal	25	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
DRC:							
Drake	90	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
						Excess salt	0.01
EcA:							
Estacado	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.57	Too clayey	0.57	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
FrB:							
Friona	80	Not limited		Somewhat limited		Very limited	
				Cemented pan	0.39	Too dry	1.00

Table 15.--Upland Wild Herbaceous Plants, Upland Shrubs and Vines, and Freshwater Wetland Plants for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland wild herbaceous plants: Rating class and limiting features	Value	Upland shrubs and vines: Rating class and limiting features	Value	Freshwater Wetland plants: Rating class and limiting features	Value
GQE:							
Glenrio	45	Very limited		Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00	Too dry	1.00
		Too arid	1.00	Bedrock	1.00		
		Droughty	0.99	Too arid	1.00		
				Droughty	0.99		
Quay	40	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
IMC:							
Ima	50	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Too sandy	0.50				
Lacoca	40	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Too dry	1.00
		Too arid	1.00	Bedrock	1.00		
		Too sandy	0.50	Too arid	1.00		
KmB:							
Kimberson	85	Very limited		Very limited		Very limited	
		Droughty	1.00	Droughty	1.00	Too dry	1.00
				Cemented pan	1.00		
LcA:							
Lazbuddie	90	Very limited		Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00	Too dry	1.00
LoA:							
Lofton	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.70	Too clayey	0.70	Too dry	1.00
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00	Too dry	1.00
MNA:							
Minneosa	90	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Too sandy	0.50				
MoC:							
Mobeetie	85	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
MoD:							
Mobeetie	85	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00

Table 15.--Upland Wild Herbaceous Plants, Upland Shrubs and Vines, and Freshwater Wetland Plants for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland wild herbaceous plants: Rating class and limiting features	Value	Upland shrubs and vines: Rating class and limiting features	Value	Freshwater Wetland plants: Rating class and limiting features	Value
MVE:							
Mobeetie	50	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
Veal	25	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
Potter	15	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Droughty	0.49	Droughty	0.49	Too alkaline	1.00
OcA:							
Olton	85	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
		Too clayey	0.05	Too clayey	0.05		
OcB:							
Olton	90	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
		Too clayey	0.05	Too clayey	0.05		
PcA:							
Pep	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.57	Too clayey	0.57	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
PcB:							
Pep	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.57	Too clayey	0.57	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
PcC:							
Pep	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.57	Too clayey	0.57	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
PGE:							
Potter	80	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Droughty	0.49	Droughty	0.49	Too alkaline	1.00
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
		Droughty	0.99	Droughty	0.99	Too alkaline	1.00
Mobeetie	40	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
PnC:							
Plemons	85	Not limited		Not limited		Very limited	
						Too dry	1.00

Table 15.--Upland Wild Herbaceous Plants, Upland Shrubs and Vines, and Freshwater Wetland Plants for Wildlife Habitat--Continued

Map symbol and soil name	Pct. of map unit	Upland wild herbaceous plants		Upland shrubs and vines		Freshwater Wetland plants	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PrA:							
Portales------------	85	Somewhat limited		Somewhat limited		Very limited	
		Too arid	0.50	Too arid	0.50	Too dry	1.00
		Too clayey	0.43	Too clayey	0.43		
PuA:							
Pullman-------------	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
PuB:							
Pullman-------------	90	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.50	Too clayey	0.50	Too dry	1.0
		Too arid	0.50	Too arid	0.50		
PxA:							
Pantex--------------	95	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.56	Too clayey	0.56	Too dry	1.00
		Too arid	0.50	Too arid	0.50		
QcB:							
Quay----------------	85	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
RaA:							
Randall-------------	90	Very limited		Very limited		Not limited	
		Wetness	1.00	Too clayey	1.00		
		Too clayey	1.00	Wetness	1.00		
RfC:							
Redona--------------	80	Very limited		Very limited		Very limited	
		Too arid	1.00	Too arid	1.00	Too dry	1.00
						Too alkaline	1.00
TuA:							
Tucumcari-----------	85	Somewhat limited		Somewhat limited		Very limited	
		Too clayey	0.19	Too clayey	0.19	Too dry	1.00
W:							
Water---------------	100	Not rated		Not rated		Not rated	

Table 16.--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
BcA:							
Bippus	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
BeD:							
Berda	85	Not limited		Not limited		Somewhat limited	
						Slope	0.50
BfB:							
Berwolf	85	Not limited		Not limited		Not limited	
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
Potter	30	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
BVD:							
Berda	60	Not limited		Not limited		Somewhat limited	
						Slope	0.50
Veal	25	Not limited		Not limited		Somewhat limited	
						Slope	0.50
DRC:							
Drake	90	Not limited		Not limited		Somewhat limited	
						Slope	0.12
EcA:							
Estacado	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
FrB:							
Friona	80	Not limited		Somewhat limited		Not limited	
				Depth to thin cemented pan	0.39		
GQE:							
Glenrio	45	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Depth to soft bedrock	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Shrink-swell	1.00
		Slope	0.16	Slope	0.16	Slope	1.00

Table 16.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
Quay	40	Not limited		Not limited		Somewhat limited	
						Slope	0.50
IMC:							
Ima	50	Not limited		Not limited		Not limited	
Lacoca	40	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	0.12
KmB:							
Kimberson	85	Somewhat limited		Very limited		Somewhat limited	
		Depth to thin cemented pan	0.50	Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
LcA:							
Lazbuddie	90	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
LoA:							
Lofton	85	Very limited		Somewhat limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	0.50	Shrink-swell	1.00
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
MNA:							
Minneosa	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
MoC:							
Mobeetie	85	Not limited		Not limited		Not limited	
MoD:							
Mobeetie	85	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
MVE:							
Mobeetie	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Veal	25	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Potter	15	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
OcA:							
Olton	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Table 16.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
OcB:							
Olton	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
PcA:							
Pep	85	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.01			Shrink-swell	0.01
PcB:							
Pep	85	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.01			Shrink-swell	0.01
PcC:							
Pep	90	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.01			Shrink-swell	0.01
PGE:							
Potter	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Mobeetie	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
PnC:							
Plemons	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.02	Shrink-swell	0.18	Shrink-swell	0.02
PrA:							
Portales	85	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.01			Shrink-swell	0.01
PuA:							
Pullman	90	Very limited		Somewhat limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	0.78	Shrink-swell	1.00
PuB:							
Pullman	90	Very limited		Somewhat limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	0.78	Shrink-swell	1.00
PxA:							
Pantex	95	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
QcB:							
Quay	85	Not limited		Not limited		Not limited	
RaA:							
Randall	90	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

Table 16.--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
RfC:							
Redona	80	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.22			Shrink-swell	0.22
TuA:							
Tucumcari	85	Very limited		Somewhat limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	0.50	Shrink-swell	1.00
W:							
Water	100	Not rated		Not rated		Not rated	

Table 17.--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
BcA:							
Bippus	85	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Flooding	0.60	Flooding	0.60
				Cutbanks cave	0.10		
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Not limited	
		Low strength	0.78	Cutbanks cave	0.10		
BfB:							
Berwolf	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Slope	1.00	Slope	1.00	Droughty	1.00
						Slope	1.00
						Gravel content	1.00
						Carbonate content	1.00
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Low strength	0.78	Cutbanks cave	0.10	Slope	0.01
		Slope	0.01	Slope	0.01		
Potter	30	Somewhat limited		Very limited		Very limited	
		Slope	0.01	Cutbanks cave	1.00	Carbonate content	1.00
				Slope	0.01	Droughty	0.99
						Slope	0.01
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Not limited	
		Low strength	0.78	Cutbanks cave	0.10		
Veal	25	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.78	Cutbanks cave	0.10	Carbonate content	1.00
DRC:							
Drake	90	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
EcA:							
Estacado	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.50				

Table 17.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Lawns and landscaping: Rating class and limiting features	Value
FrB:							
Friona	80	Very limited		Somewhat limited		Somewhat limited	
		Low strength	1.00	Depth to thin cemented pan	0.39	Depth to cemented pan	0.38
				Cutbanks cave	0.10		
GQE:							
Glenrio	45	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	0.16	Too clayey	1.00
		Shrink-swell	1.00	Cutbanks cave	0.10	Droughty	0.99
		Slope	0.16			Slope	0.16
Quay	40	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
IMC:							
Ima	50	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
Lacoca	40	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
				Cutbanks cave	0.10	Droughty	1.00
KmB:							
Kimberson	85	Somewhat limited		Very limited		Very limited	
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Depth to cemented pan	1.00
				Cutbanks cave	1.00	Carbonate content	1.00
						Droughty	1.00
LcA:							
Lazbuddie	90	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Too clayey	1.00	Too clayey	1.00
		Low strength	1.00	Cutbanks cave	1.00		
LoA:							
Lofton	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Too clayey	0.12		
		Shrink-swell	1.00	Cutbanks cave	0.10		
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Ponding	1.00	Too clayey	1.00
		Ponding	1.00	Cutbanks cave	1.00	Ponding	1.00
		Low strength	1.00	Too clayey	0.99		
MNA:							
Minneosa	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	0.60
				Flooding	0.60	Droughty	0.01

Table 17.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Lawns and landscaping: Rating class and limiting features	Value
MoC:							
Mobeetie	85	Not limited		Somewhat limited		Not limited	
				Cutbanks cave	0.10		
MoD:							
Mobeetie	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.01	Cutbanks cave	0.10	Slope	0.01
				Slope	0.01		
MVE:							
Mobeetie	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
				Cutbanks cave	0.10		
Veal	25	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Low strength	0.78	Cutbanks cave	0.10	Carbonate content	1.00
Potter	15	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Cutbanks cave	1.00	Carbonate content	1.00
				Slope	0.63	Slope	0.63
						Droughty	0.51
OcA:							
Olton	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.50				
OcB:							
Olton	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.50				
PcA:							
Pep	85	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Cutbanks cave	0.10	Carbonate content	1.00
		Shrink-swell	0.01				
PcB:							
Pep	85	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Cutbanks cave	0.10	Carbonate content	1.00
		Shrink-swell	0.01				
PcC:							
Pep	90	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Cutbanks cave	0.10	Carbonate content	1.00
		Shrink-swell	0.01				
PGE:							
Potter	80	Somewhat limited		Very limited		Very limited	
		Slope	0.01	Cutbanks cave	1.00	Carbonate content	1.00
				Slope	0.01	Droughty	0.51
						Slope	0.01

Table 17.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Lawns and landscaping: Rating class and limiting features	Value
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Slope	1.00	Cutbanks cave	1.00	Slope	1.00
				Slope	1.00	Carbonate content	1.00
						Droughty	0.99
Mobeetie	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
				Cutbanks cave	0.10		
PnC:							
Plemons	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.02				
PrA:							
Portales	85	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Cutbanks cave	0.10	Carbonate content	1.00
		Shrink-swell	0.01				
PuA:							
Pullman	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00	Too clayey	0.06		
PuB:							
Pullman	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00	Too clayey	0.06		
PxA:							
Pantex	95	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00	Too clayey	0.02		
QcB:							
Quay	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
RaA:							
Randall	90	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Ponding	1.00	Too clayey	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Cutbanks cave	1.00	Depth to saturated zone	1.00
		Low strength	1.00	Too clayey	1.00		
RfC:							
Redona	80	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.22	Cutbanks cave	0.10		
TuA:							
Tucumcari	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00	Too clayey	0.03		

Table 17.--Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Local roads and streets: Value	Shallow excavations: Rating class and limiting features	Shallow excavations: Value	Lawns and landscaping: Rating class and limiting features	Lawns and landscaping: Value
W:							
Water	100	Not rated		Not rated		Not rated	

Table 18.--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
BcA:					
Bippus	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
BeD:					
Berda	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
BfB:					
Berwolf	85	Not limited		Very limited	
				Seepage	1.00
BP:					
Borrow pits	95	Very limited		Very limited	
		Ponding	1.00	Ponding	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	1.00		
BpD:					
Berda	55	Somewhat limited		Very limited	
		Slow water movement	0.50	Slope	1.00
		Slope	0.01	Seepage	0.50
Potter	30	Somewhat limited		Very limited	
		Slope	0.01	Slope	1.00
				Seepage	0.50
BVD:					
Berda	60	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Veal	25	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
DRC:					
Drake	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.68
				Seepage	0.50

Table 18.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
EcA:					
Estacado	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
FrB:					
Friona	80	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Slow water movement	0.50	Seepage	0.50
GQE:					
Glenrio	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.16	Slope	1.00
Quay	40	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
IMC:					
Ima	50	Not limited		Very limited	
				Seepage	1.00
				Slope	0.08
Lacoca	40	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	0.68
KmB:					
Kimberson	85	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
				Seepage	0.27
LcA:					
Lazbuddie	90	Very limited		Not limited	
		Slow water movement	1.00		
LoA:					
Lofton	85	Very limited		Not limited	
		Slow water movement	1.00		
M-W:					
Water, miscellaneous	100	Not rated		Not rated	

Table 18.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
McA:					
McLean	85	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00
		Ponding	1.00		
MNA:					
Minneosa	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
				Seepage	1.00
MoC:					
Mobeetie	85	Not limited		Very limited	
				Seepage	1.00
				Slope	0.32
MoD:					
Mobeetie	85	Somewhat limited		Very limited	
		Slope	0.01	Seepage	1.00
				Slope	1.00
MVE:					
Mobeetie	50	Very limited		Very limited	
		Slope	1.00	Seepage	1.00
				Slope	1.00
Veal	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Potter	15	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.63	Seepage	0.50
OcA:					
Olton	85	Very limited		Not limited	
		Slow water movement	1.00		
OcB:					
Olton	90	Very limited		Not limited	
		Slow water movement	1.00		
PcA:					
Pep	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
PcB:					
Pep	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Table 18.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
PcC:					
Pep	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.32
PGE:					
Potter	80	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.01	Seepage	0.50
PMG:					
Potter	45	Very limited		Very limited	
		Slope	1.00	Slope	1.00
				Seepage	0.50
Mobeetie	40	Very limited		Very limited	
		Slope	1.00	Slope	1.00
				Seepage	1.00
PnC:					
Plemons	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
				Slope	0.32
PrA:					
Portales	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
PuA:					
Pullman	90	Very limited		Not limited	
		Slow water movement	1.00		
PuB:					
Pullman	90	Very limited		Not limited	
		Slow water movement	1.00		
PxA:					
Pantex	95	Very limited		Not limited	
		Slow water movement	1.00		
QcB:					
Quay	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08

Table 18.--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
RaA:					
Randall	90	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		
RfC:					
Redona	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
TuA:					
Tucumcari	85	Very limited		Not limited	
		Slow water movement	1.00		
W:					
Water	100	Not rated		Not rated	

Table 19.--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: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
BcA:							
Bippus	85	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
BeD:							
Berda	85	Not limited		Not limited		Not limited	
BfB:							
Berwolf	85	Not limited		Not limited		Somewhat limited	
						Seepage	0.52
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Slope	1.00	Slope	1.00	Gravel content	1.00
						Slope	1.00
						Carbonate content	1.00
BpD:							
Berda	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.01	Slope	0.01	Slope	0.01
Potter	30	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Gravel content	1.00
						Carbonate content	1.00
						Slope	0.01
BVD:							
Berda	60	Not limited		Not limited		Not limited	
Veal	25	Not limited		Not limited		Very limited	
						Carbonate content	1.00
DRC:							
Drake	90	Not limited		Not limited		Not limited	
EcA:							
Estacado	85	Not limited		Not limited		Not limited	
FrB:							
Friona	80	Somewhat limited		Very limited		Very limited	
		Depth to thin cemented pan	0.50	Depth to cemented pan	1.00	Depth to cemented pan	1.00
GQE:							
Glenrio	45	Very limited		Somewhat limited		Very limited	
		Depth to bedrock	1.00	Slope	0.16	Depth to bedrock	1.00
		Slope	0.16			Slope	0.16
Quay	40	Not limited		Not limited		Not limited	

Table 19.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
IMC:							
Ima	50	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
Lacoca	40	Very limited		Not limited		Very limited	
		Depth to bedrock	1.00			Depth to bedrock	1.00
		Too sandy	0.50			Seepage	0.50
						Too sandy	0.50
KmB:							
Kimberson	85	Somewhat limited		Very limited		Very limited	
		Depth to thin cemented pan	0.50	Depth to cemented pan	1.00	Depth to cemented pan	1.00
						Gravel content	0.47
LcA:							
Lazbuddie	90	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
						Hard to compact	1.00
LoA:							
Lofton	85	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Too clayey	1.00			Too clayey	1.00
						Hard to compact	1.00
MNA:							
Minneosa	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Seepage	1.00
		Too sandy	0.50			Too sandy	0.50
MoC:							
Mobeetie	85	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
MoD:							
Mobeetie	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.01	Slope	0.01	Seepage	0.50
						Slope	0.01
MVE:							
Mobeetie	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
						Seepage	0.50
Veal	25	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
						Carbonate content	1.00

Table 19.--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
Potter	15	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Gravel content	1.00
						Carbonate content	1.00
						Slope	0.63
OcA:							
Olton	85	Not limited		Not limited		Not limited	
OcB:							
Olton	90	Not limited		Not limited		Not limited	
PcA:							
Pep	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PcB:							
Pep	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PcC:							
Pep	90	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PGE:							
Potter	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Gravel content	1.00
						Carbonate content	1.00
						Slope	0.01
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Gravel content	1.00
						Slope	1.00
						Carbonate content	1.00
Mobeetie	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
						Seepage	0.50
PnC:							
Plemons	85	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
PrA:							
Portales	85	Not limited		Not limited		Very limited	
						Carbonate content	1.00
PuA:							
Pullman	90	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00
PuB:							
Pullman	90	Very limited		Not limited		Very limited	
		Too clayey	1.00			Too clayey	1.00

Table 19.--Landfills--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill: Rating class and limiting features	Value	Area sanitary landfill: Rating class and limiting features	Value	Daily cover for landfill: Rating class and limiting features	Value
PxA:							
Pantex	95	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
QcB:							
Quay	85	Not limited		Not limited		Not limited	
RaA:							
Randall	90	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
RfC:							
Redona	80	Not limited		Not limited		Not limited	
TuA:							
Tucumcari	85	Not limited		Not limited		Not limited	
W:							
Water	100	Not rated		Not rated		Not rated	

Table 20.--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
BcA:					
Bippus	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BeD:					
Berda	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BfB:					
Berwolf	85	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.01
		Thickest layer	0.00	Thickest layer	0.06
BP:					
Borrow pits	95	Fair		Poor	
		Bottom layer	0.38	Bottom layer	0.00
		Thickest layer	0.38	Thickest layer	0.00
BpD:					
Berda	55	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Potter	30	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.68	Bottom layer	0.04
BVD:					
Berda	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Veal	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
DRC:					
Drake	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
EcA:					
Estacado	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 20.--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
FrB:					
Friona	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
GQE:					
Glenrio	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Quay	40	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
IMC:					
Ima	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Lacoca	40	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.05
KmB:					
Kimberson	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LcA:					
Lazbuddie	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LoA:					
Lofton	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
M-W:					
Water, miscellaneous	100	Not rated		Not rated	
McA:					
McLean	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
MNA:					
Minneosa	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.06
		Thickest layer	0.00	Bottom layer	0.75
MoC:					
Mobeetie	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 20.--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
MoD:					
Mobeetie------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
MVE:					
Mobeetie------------	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Veal----------------	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Potter--------------	15	Fair		Fair	
		Thickest layer	0.38	Thickest layer	0.00
		Bottom layer	0.68	Bottom layer	0.04
OcA:					
Olton---------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
OcB:					
Olton---------------	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PcA:					
Pep-----------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PcB:					
Pep-----------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PcC:					
Pep-----------------	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PGE:					
Potter--------------	80	Fair		Fair	
		Thickest layer	0.38	Thickest layer	0.00
		Bottom layer	0.68	Bottom layer	0.04
PMG:					
Potter--------------	45	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.68	Bottom layer	0.04
Mobeetie------------	40	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 20.--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
PnC:					
Plemons	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PrA:					
Portales	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PuA:					
Pullman	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PuB:					
Pullman	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
PxA:					
Pantex	95	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
QcB:					
Quay	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
RaA:					
Randall	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
RfC:					
Redona	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
TuA:					
Tucumcari	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	

Table 21.--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: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
BcA:							
Bippus	85	Fair		Good		Good	
		Organic matter content low	0.24				
BeD:							
Berda	85	Fair		Fair		Fair	
		Organic matter content low	0.18	Low strength	0.78	Too clayey	0.30
		Too clayey	0.50				
		Water erosion	0.99				
BfB:							
Berwolf	85	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.71
		Organic matter content low	0.08				
		Carbonate content	0.32				
		Too sandy	0.71				
BP:							
Borrow pits	95	Poor		Fair		Poor	
		Carbonate content	0.00	Slope	0.08	Rock fragments	0.00
		Droughty	0.01			Carbonate content	0.00
		Organic matter content low	0.08			Slope	0.00
						Hard to reclaim (rock fragments)	0.00
BpD:							
Berda	55	Fair		Fair		Fair	
		Organic matter content low	0.18	Low strength	0.78	Too clayey	0.30
		Too clayey	0.50				
		Water erosion	0.99				
Potter	30	Poor		Good		Poor	
		Droughty	0.00			Rock fragments	0.00
		Carbonate content	0.00			Carbonate content	0.00
		Organic matter content low	0.77				
BVD:							
Berda	60	Fair		Fair		Fair	
		Organic matter content low	0.18	Low strength	0.78	Too clayey	0.30
		Too clayey	0.50				
		Water erosion	0.99				

Table 21.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
Veal	25	Poor		Fair		Fair	
		Carbonate content	0.00	Low strength	0.22	Carbonate content	0.09
		Organic matter content low	0.18				
DRC:							
Drake	90	Fair		Good		Fair	
		Organic matter content low	0.18			Sodium content	0.78
		Sodium content	0.78				
		Carbonate content	0.92				
EcA:							
Estacado	85	Fair		Poor		Fair	
		Organic matter content low	0.18	Low strength	0.00	Too clayey	0.30
		Carbonate content	0.32	Shrink-swell	0.87		
		Too clayey	0.50				
FrB:							
Friona	80	Fair		Poor		Fair	
		Carbonate content	0.08	Depth to cemented pan	0.00	Depth to cemented pan	0.62
		Organic matter content low	0.37	Low strength	0.00		
		Depth to cemented pan	0.62				
		Droughty	0.68				
GQE:							
Glenrio	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Low strength	0.00	Too clayey	0.00
		Too clayey	0.00	Shrink-swell	0.12	Slope	0.84
		Organic matter content low	0.60				
		Water erosion	0.99				
Quay	40	Fair		Fair		Good	
		Organic matter content low	0.12	Low strength	0.22		
		Carbonate content	0.32				
		Water erosion	0.99				
IMC:							
Ima	50	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.05				
Lacoca	40	Poor		Poor		Poor	
		Wind erosion	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00			Too sandy	0.20
		Depth to bedrock	0.00				
		Too sandy	0.20				
		Organic matter content low	0.60				

Table 21.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
KmB:							
Kimberson-----------	85	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Depth to cemented pan	0.00
		Carbonate content	0.00			Rock fragments	0.00
		Depth to cemented pan	0.00				
		Too alkaline	0.00				
LcA:							
Lazbuddie-----------	90	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Carbonate content	0.20	Low strength	0.00	Carbonate content	0.84
		Organic matter content low	0.22				
LoA:							
Lofton--------------	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.18	Shrink-swell	0.43		
		Carbonate content	0.92				
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean--------------	85	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Organic matter content low	0.61	Low strength	0.00		
MNA:							
Minneosa------------	90	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.03
		Too sandy	0.03				
		Organic matter content low	0.32				
MoC:							
Mobeetie------------	85	Fair		Good		Good	
		Organic matter content low	0.18				
MoD:							
Mobeetie------------	85	Fair		Good		Good	
		Organic matter content low	0.18				
MVE:							
Mobeetie------------	50	Fair		Good		Poor	
		Organic matter content low	0.18			Slope	0.00

Table 21.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
Veal	25	Poor		Fair		Poor	
		Carbonate content	0.00	Low strength	0.22	Slope	0.00
		Organic matter content low	0.18			Carbonate content	0.09
Potter	15	Poor		Good		Poor	
		Carbonate content	0.00			Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.08			Rock fragments	0.00
		Droughty	0.60			Carbonate content	0.00
						Slope	0.37
OcA:							
Olton	85	Poor		Poor		Fair	
		Carbonate content	0.00	Low strength	0.00	Too clayey	0.17
		Organic matter content low	0.16	Shrink-swell	0.87		
		Too clayey	0.23				
OcB:							
Olton	90	Poor		Poor		Fair	
		Carbonate content	0.00	Low strength	0.00	Too clayey	0.17
		Organic matter content low	0.16	Shrink-swell	0.87		
		Too clayey	0.23				
PcA:							
Pep	85	Poor		Poor		Fair	
		Carbonate content	0.00	Low strength	0.00	Too clayey	0.61
		Organic matter content low	0.18				
		Too clayey	0.98				
PcB:							
Pep	85	Poor		Poor		Fair	
		Carbonate content	0.00	Low strength	0.00	Too clayey	0.61
		Organic matter content low	0.18				
		Too clayey	0.98				
PcC:							
Pep	90	Poor		Poor		Fair	
		Carbonate content	0.00	Low strength	0.00	Too clayey	0.61
		Organic matter content low	0.18				
		Too clayey	0.98				
PGE:							
Potter	80	Poor		Good		Poor	
		Carbonate content	0.00			Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.08			Rock fragments	0.00
		Droughty	0.60			Carbonate content	0.00

Table 21.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
PMG:							
Potter	45	Poor		Fair		Poor	
		Droughty	0.00	Slope	0.82	Rock fragments	0.00
		Carbonate content	0.00			Carbonate content	0.00
		Organic matter content low	0.77			Slope	0.00
Mobeetie	40	Fair		Poor		Poor	
		Organic matter content low	0.18	Slope	0.00	Slope	0.00
PnC:							
Plemons	85	Fair		Poor		Fair	
		Organic matter content low	0.50	Low strength	0.00	Too clayey	0.65
		Carbonate content	0.54	Shrink-swell	0.98		
		Water erosion	0.99				
		Too clayey	0.99				
PrA:							
Portales	85	Poor		Poor		Good	
		Carbonate content	0.00	Low strength	0.00		
		Water erosion	0.99				
PuA:							
Pullman	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Carbonate content	0.00	Shrink-swell	0.58		
		Organic matter content low	0.18				
PuB:							
Pullman	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Carbonate content	0.00	Shrink-swell	0.61		
		Organic matter content low	0.18				
PxA:							
Pantex	95	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Carbonate content	0.00	Shrink-swell	0.04		
		Organic matter content low	0.18				
		Water erosion	0.99				
QcB:							
Quay	85	Fair		Fair		Good	
		Organic matter content low	0.12	Low strength	0.22		
		Carbonate content	0.32				
		Water erosion	0.99				

Table 21.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
RaA:							
Randall	90	Poor		Poor		Poor	
		Too clayey	0.00	Wetness depth	0.00	Too clayey	0.00
		Organic matter content low	0.34	Shrink-swell	0.00	Wetness depth	0.00
		Too acid	0.95	Low strength	0.00		
RfC:							
Redona	80	Fair		Good		Good	
		Organic matter content low	0.18				
		Carbonate content	0.80				
TuA:							
Tucumcari	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Organic matter content low	0.05	Shrink-swell	0.31		
W:							
Water	100	Not rated		Not rated		Not rated	

Table 22.--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
BcA:							
Bippus	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.77	Depth to water	1.00
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.05	Depth to water	1.00
		Slope	0.68				
BfB:							
Berwolf	85	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.06	Depth to water	1.00
BP:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Slope	1.00	Ponding	1.00	Depth to water	1.00
				Seepage	0.38		
BpD:							
Berda	55	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Piping	0.05	Depth to water	1.00
		Seepage	0.70				
Potter	30	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.01	Seepage	0.68		
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.05	Depth to water	1.00
		Slope	0.68				
Veal	25	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.61	Depth to water	1.00
		Slope	0.68				
DRC:							
Drake	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.22	Depth to water	1.00
		Slope	0.32				
EcA:							
Estacado	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
FrB:							
Friona	80	Somewhat limited		Somewhat limited		Very limited	
		Depth to cemented pan	0.84	Thin layer	0.84	Depth to water	1.00
		Seepage	0.70	Piping	0.64		

Table 22.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
GQE:							
Glenrio	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	0.69	Hard to pack	0.32		
Quay	40	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.91	Depth to water	1.00
		Slope	0.68				
IMC:							
Ima	50	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
Lacoca	40	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	0.32	Seepage	0.05		
KmB:							
Kimberson	85	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.53				
LcA:							
Lazbuddie	90	Not limited		Very limited		Very limited	
				Hard to pack	1.00	Depth to water	1.00
LoA:							
Lofton	85	Not limited		Not limited		Very limited	
						Depth to water	1.00
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	
McA:							
McLean	85	Not limited		Very limited		Very limited	
				Ponding	1.00	Depth to water	1.00
				Hard to pack	1.00		
MNA:							
Minneosa	90	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.75	Depth to water	1.00
MoC:							
Mobeetie	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	0.08				
MoD:							
Mobeetie	85	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	1.00				
MVE:							
Mobeetie	50	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	1.00				

Table 22.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
Veal----------------	25	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Piping	0.61	Depth to water	1.00
		Seepage	0.70				
Potter--------------	15	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Seepage	0.68	Depth to water	1.00
		Seepage	0.01				
OcA:							
Olton---------------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.03	Piping	0.01	Depth to water	1.00
OcB:							
Olton---------------	90	Somewhat limited		Not limited		Very limited	
		Seepage	0.03			Depth to water	1.00
PcA:							
Pep-----------------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.16	Depth to water	1.00
PcB:							
Pep-----------------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.17	Depth to water	1.00
PcC:							
Pep-----------------	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.17	Depth to water	1.00
		Slope	0.08				
PGE:							
Potter--------------	80	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Seepage	0.68	Depth to water	1.00
		Seepage	0.01				
PMG:							
Potter--------------	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Seepage	0.01	Seepage	0.68		
Mobeetie------------	40	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	1.00				
PnC:							
Plemons-------------	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
		Slope	0.08				
PrA:							
Portales------------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.01	Depth to water	1.00
PuA:							
Pullman-------------	90	Somewhat limited		Not limited		Very limited	
		Seepage	0.03			Depth to water	1.00

Table 22.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
PuB:							
Pullman	90	Somewhat limited		Not limited		Very limited	
		Seepage	0.03			Depth to water	1.00
PxA:							
Pantex	95	Somewhat limited		Not limited		Very limited	
		Seepage	0.03			Depth to water	1.00
QcB:							
Quay	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.91	Depth to water	1.00
RaA:							
Randall	90	Not limited		Very limited		Very limited	
				Ponding	1.00	Slow refill	1.00
				Depth to saturated zone	1.00	Cutbanks cave	0.10
				Hard to pack	1.00		
RfC:							
Redona	80	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
TuA:							
Tucumcari	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.03			Depth to water	1.00
W:							
Water	100	Not rated		Not rated		Not rated	

Table 23.--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: Rating class and limiting features	Value	Constructing terraces and diversions: Rating class and limiting features	Value	Tile drains and underground outlets: Rating class and limiting features	Value
BcA:							
Bippus	85	Not limited		Somewhat limited		Somewhat limited	
				K factor	0.88	Occasional flooding	0.60
BeD:							
Berda	85	Somewhat limited		Very limited		Not limited	
		Slope	0.84	K factor	1.00		
				HEL wind	1.00		
				Slope	0.84		
BfB:							
Berwolf	85	Somewhat limited		Very limited		Not limited	
		Slope	0.04	HEL wind	1.00		
				K factor	0.12		
				Slope	0.04		
BP:							
Borrow pits	95	Very limited		Very limited		Not rated	
		Slope	1.00	Ponding	1.00		
				Slope	1.00		
BpD:							
Berda	55	Very limited		Very limited		Not limited	
		Slope	1.00	K factor	1.00		
				HEL wind	1.00		
				Slope	1.00		
Potter	30	Very limited		Very limited		Very limited	
		Slope	1.00	HEL wind	1.00	Expect caving	1.00
				Slope	1.00		
BVD:							
Berda	60	Somewhat limited		Very limited		Not limited	
		Slope	0.84	K factor	1.00		
				HEL wind	1.00		
				Slope	0.84		
Veal	25	Somewhat limited		Very limited		Not limited	
		Slope	0.84	HEL wind	1.00		
				Slope	0.84		
				K factor	0.50		
DRC:							
Drake	90	Somewhat limited		Very limited		Not limited	
		Slope	0.63	HEL wind	1.00		
				K factor	0.88		
				Slope	0.63		

Table 23.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains: Rating class and limiting features	Value	Constructing terraces and diversions: Rating class and limiting features	Value	Tile drains and underground outlets: Rating class and limiting features	Value
EcA:							
Estacado------------	85	Not limited		Very limited		Not limited	
				HEL wind	1.00		
				K factor	0.88		
FrB:							
Friona--------------	80	Somewhat limited		Very limited		Somewhat limited	
		Thin cemented pan	0.39	HEL wind	1.00	Thin cemented pan	0.39
		Slope	0.04	K factor	0.88		
				Thin cemented pan	0.39		
				Slope	0.04		
GQE:							
Glenrio-------------	45	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	K factor	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Depth to soft bedrock	1.00	Slope	0.16
				HEL wind	1.00		
				Slope	1.00		
Quay----------------	40	Somewhat limited		Very limited		Not limited	
		Slope	0.84	K factor	1.00		
				HEL wind	1.00		
				Slope	0.84		
IMC:							
Ima-----------------	50	Somewhat limited		Very limited		Not limited	
		Slope	0.16	HEL wind	1.00		
				Slope	0.16		
				K factor	0.12		
Lacoca--------------	40	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	0.63	HEL wind	1.00		
				Slope	0.63		
KmB:							
Kimberson-----------	85	Very limited		Very limited		Very limited	
		Thin cemented pan	1.00	Thin cemented pan	1.00	Thin cemented pan	1.00
				HEL wind	1.00	Expect caving	1.00
LcA:							
Lazbuddie-----------	90	Not limited		Somewhat limited		Very limited	
				K factor	0.88	Expect caving	1.00
						Too clayey	1.00
LoA:							
Lofton--------------	85	Not limited		Somewhat limited		Somewhat limited	
				K factor	0.88	Too clayey	0.12
M-W:							
Water, miscellaneous	100	Not rated		Not rated		Not rated	

Table 23.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains: Rating class and limiting features	Value	Constructing terraces and diversions: Rating class and limiting features	Value	Tile drains and underground outlets: Rating class and limiting features	Value
McA:							
McLean	85	Not limited		Very limited		Very limited	
				Ponding	1.00	Ponding	1.00
				K factor	0.88	Expect caving	1.00
						Too clayey	0.99
MNA:							
Minneosa	90	Not limited		Very limited		Very limited	
				HEL wind	1.00	Expect caving	1.00
						Occasional flooding	0.60
MoC:							
Mobeetie	85	Somewhat limited		Very limited		Not limited	
		Slope	0.37	HEL wind	1.00		
				Slope	0.37		
				K factor	0.12		
MoD:							
Mobeetie	85	Very limited		Very limited		Not limited	
		Slope	1.00	HEL wind	1.00		
				Slope	1.00		
				K factor	0.12		
MVE:							
Mobeetie	50	Very limited		Very limited		Very limited	
		Slope	1.00	HEL wind	1.00	Slope	1.00
				Slope	1.00		
				K factor	0.12		
Veal	25	Very limited		Very limited		Very limited	
		Slope	1.00	HEL wind	1.00	Slope	1.00
				Slope	1.00		
				K factor	0.50		
Potter	15	Very limited		Very limited		Very limited	
		Slope	1.00	HEL wind	1.00	Expect caving	1.00
				Slope	1.00	Slope	0.63
OcA:							
Olton	85	Not limited		Somewhat limited		Not limited	
				K factor	0.88		
OcB:							
Olton	90	Somewhat limited		Somewhat limited		Not limited	
		Slope	0.04	K factor	0.88		
				Slope	0.04		
PcA:							
Pep	85	Not limited		Very limited		Not limited	
				HEL wind	1.00		
				K factor	0.88		

Table 23.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains: Rating class and limiting features	Value	Constructing terraces and diversions: Rating class and limiting features	Value	Tile drains and underground outlets: Rating class and limiting features	Value
PcB:							
Pep	85	Somewhat limited		Very limited		Not limited	
		Slope	0.04	HEL wind	1.00		
				K factor	0.88		
				Slope	0.04		
PcC:							
Pep	90	Somewhat limited		Very limited		Not limited	
		Slope	0.37	HEL wind	1.00		
				K factor	0.88		
				Slope	0.37		
PGE:							
Potter	80	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Expect caving	1.00
PMG:							
Potter	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Expect caving	1.00
				HEL wind	1.00	Slope	1.00
Mobeetie	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
				HEL wind	1.00		
				K factor	0.12		
PnC:							
Plemons	85	Somewhat limited		Very limited		Not limited	
		Slope	0.37	K factor	1.00		
				HEL wind	1.00		
				Slope	0.37		
PrA:							
Portales	85	Not limited		Very limited		Not limited	
				HEL wind	1.00		
				K factor	0.88		
PuA:							
Pullman	90	Not limited		Somewhat limited		Somewhat limited	
				K factor	0.88	Too clayey	0.06
PuB:							
Pullman	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.04	K factor	0.88	Too clayey	0.06
				Slope	0.04		
PxA:							
Pantex	95	Not limited		Very limited		Somewhat limited	
				K factor	1.00	Too clayey	0.02
QcB:							
Quay	85	Somewhat limited		Very limited		Not limited	
		Slope	0.16	K factor	1.00		
				HEL wind	1.00		
				Slope	0.16		

Table 23.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Constructing grassed waterways and surface drains		Constructing terraces and diversions		Tile drains and underground outlets	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RaA:							
Randall-------------	90	Not limited		Very limited		Very limited	
				Ponding	1.00	Ponding	1.00
				Depth to saturated zone	1.00	Depth to saturated zone	1.00
				K factor	0.88	Expect caving	1.00
						Too clayey	1.00
RfC:							
Redona--------------	80	Somewhat limited		Very limited		Not limited	
		Slope	0.16	HEL wind	1.00		
				K factor	0.88		
				Slope	0.16		
TuA:							
Tucumcari-----------	85	Not limited		Very limited		Somewhat limited	
				HEL wind	1.00	Too clayey	0.03
				K factor	0.88		
W:							
Water---------------	100	Not rated		Not rated		Not rated	

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Table 24.--Irrigation System 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	Sprinkler irrigation: Rating class and limiting features	Value	Drip or trickle irrigation: Rating class and limiting features	Value
BcA:							
Bippus	85	Somewhat limited		Not limited		Not limited	
		Occasional flooding	0.60				
BeD:							
Berda	85	Somewhat limited		Somewhat limited		Not limited	
		Slope	0.68	Droughty	0.18		
BfB:							
Berwolf	85	Not limited		Very limited		Not limited	
				Wind erosion	1.00		
				Droughty	0.76		
BP:							
Borrow pits	95	Not rated		Not Rated		Not Rated	
BpD:							
Berda	55	Very limited		Somewhat limited		Not limited	
		Slope	1.00	Droughty	0.18		
		Slopes, sprinkler irrigation	0.10	Slopes, sprinkler irrigation	0.10		
Potter	30	Very limited		Very limited		Not limited	
		Droughty	1.00	Droughty	1.00		
		Slope	1.00	Slopes, sprinkler irrigation	0.10		
		Slopes, sprinkler irrigation	0.10				
BVD:							
Berda	60	Somewhat limited		Somewhat limited		Not limited	
		Slope	0.68	Droughty	0.18		
Veal	25	Somewhat limited		Somewhat limited		Not limited	
		Slope	0.68	Droughty	0.79		
DRC:							
Drake	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Excess Sodium	0.32	Excess Sodium	0.78	Excess Sodium	0.78
		Slope	0.32	Droughty	0.58		
EcA:							
Estacado	85	Not limited		Not limited		Not limited	
FrB:							
Friona	80	Somewhat limited		Very limited		Somewhat limited	
		Cemented pan	0.39	Cemented pan	1.00	Cemented pan	0.39
		Droughty	0.37	Droughty	0.69		

Table 24.--Irrigation System Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods: Rating class and limiting features	Value	Sprinkler irrigation: Rating class and limiting features	Value	Drip or trickle irrigation: Rating class and limiting features	Value
GQE:							
Glenrio	45	Very limited		Very limited		Very limited	
		Bedrock	1.00	Depth to soft bedrock	1.00	Depth to bedrock	1.00
		Droughty	1.00	Droughty	1.00	Surface percs slowly	1.00
		Percs slowly	1.00	Water erodibility	1.00		
		Slope	1.00	Surface percs slowly	1.00		
		Slopes, sprinkler irrigation	0.40	Slopes, sprinkler irrigation	0.40		
Quay	40	Somewhat limited		Very limited		Not limited	
		Slope	0.68	Water erodibility	1.00		
IMC:							
Ima	50	Not limited		Very limited		Not limited	
				Wind erosion	1.00		
				Droughty	0.58		
Lacoca	40	Very limited		Very limited		Very limited	
		Bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Droughty	1.00	Wind erosion	1.00		
		Slope	0.32	Droughty	1.00		
KmB:							
Kimberson	85	Very limited		Very limited		Very limited	
		Droughty	1.00	Cemented pan	1.00	Cemented pan	1.00
		Cemented pan	1.00	Droughty	1.00		
LcA:							
Lazbuddie	90	Very limited		Very limited		Not limited	
		Percs slowly	1.00	Surface clay	1.00		
LoA:							
Lofton	85	Very limited		Not limited		Not limited	
		Percs slowly	1.00				
M-W:							
Water, miscellaneous	100	Not rated		Not Rated		Not Rated	
McA:							
McLean	85	Very limited		Very limited		Very limited	
		Percs slowly	1.00	Ponding	1.00	Ponding	1.00
		Ponding	1.00				
MNA:							
Minneosa	90	Somewhat limited		Very limited		Not limited	
		Occasional flooding	0.60	Wind erosion	1.00		
				Droughty	0.99		
MoC:							
Mobeetie	85	Somewhat limited		Somewhat limited		Not limited	
		Slope	0.08	Droughty	0.91		

Table 24.--Irrigation System Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods: Rating class and limiting features	Value	Sprinkler irrigation: Rating class and limiting features	Value	Drip or trickle irrigation: Rating class and limiting features	Value
MoD:							
Mobeetie	85	Very limited		Somewhat limited		Not limited	
		Slope	1.00	Droughty	0.93		
		Slopes, sprinkler irrigation	0.10	Slopes, sprinkler irrigation	0.10		
MVE:							
Mobeetie	50	Very limited		Very limited		Not limited	
		Slope	1.00	Slopes, sprinkler irrigation	1.00		
		Slopes, sprinkler irrigation	1.00	Droughty	0.91		
Veal	25	Very limited		Very limited		Not limited	
		Slope	1.00	Slopes, sprinkler irrigation	1.00		
		Slopes, sprinkler irrigation	1.00	Droughty	0.79		
Potter	15	Very limited		Very limited		Not limited	
		Slope	1.00	Droughty	1.00		
		Percs slowly	0.86	Slopes, sprinkler irrigation	0.78		
		Slopes, sprinkler irrigation	0.78				
		Droughty	0.46				
OcA:							
Olton	85	Somewhat limited		Not limited		Not limited	
		Percs slowly	0.38				
OcB:							
Olton	90	Somewhat limited		Not limited		Not limited	
		Percs slowly	0.38				
PcA:							
Pep	85	Not limited		Somewhat limited		Not limited	
				Droughty	0.06		
PcB:							
Pep	85	Not limited		Somewhat limited		Not limited	
				Droughty	0.07		
PcC:							
Pep	90	Somewhat limited		Very limited		Not limited	
		Slope	0.08	Water erodibility	1.00		
				Droughty	0.09		
PGE:							
Potter	80	Very limited		Very limited		Not limited	
		Slope	1.00	Droughty	1.00		
		Percs slowly	0.86	Slopes, sprinkler irrigation	0.10		
		Droughty	0.46				
		Slopes, sprinkler irrigation	0.10				

Table 24.--Irrigation System Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods: Rating class and limiting features	Value	Sprinkler irrigation: Rating class and limiting features	Value	Drip or trickle irrigation: Rating class and limiting features	Value
PMG:							
Potter	45	Very limited		Very limited		Not limited	
		Droughty	1.00	Droughty	1.00		
		Slope	1.00	Slopes, sprinkler irrigation	1.00		
		Slopes, sprinkler irrigation	1.00				
Mobeetie	40	Very limited		Very limited		Not limited	
		Slope	1.00	Slopes, sprinkler irrigation	1.00		
		Slopes, sprinkler irrigation	1.00	Droughty	0.91		
PnC:							
Plemons	85	Somewhat limited		Very limited		Not limited	
		Slope	0.08	Water erodibility	1.00		
				Droughty	0.04		
PrA:							
Portales	85	Not limited		Somewhat limited		Not limited	
				Droughty	0.02		
PuA:							
Pullman	90	Very limited		Not limited		Not limited	
		Percs slowly	1.00				
PuB:							
Pullman	90	Very limited		Not limited		Not limited	
		Percs slowly	1.00				
PxA:							
Pantex	95	Very limited		Somewhat limited		Somewhat limited	
		Percs slowly	1.00	Excess Sodium	0.22	Excess Sodium	0.22
QcB:							
Quay	85	Not limited		Very limited		Not limited	
				Water erodibility	1.00		
RaA:							
Randall	90	Very limited		Very limited		Very limited	
		Percs slowly	1.00	Ponding	1.00	Ponding	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Wetness	1.00
		Depth to saturated zone	1.00	Surface clay	1.00	Wetness	1.00
		Too acid	0.14				
RfC:							
Redona	80	Not limited		Somewhat limited		Somewhat limited	
				Droughty	0.13	Excess Sodium	0.10
				Excess Sodium	0.10		
TuA:							
Tucumcari	85	Somewhat limited		Not limited		Not limited	
		Percs slowly	0.38				

Table 24.--Irrigation System Management--Continued

Map symbol and soil name	Pct. of map unit	Irrigation all application methods: Rating class and limiting features	Value	Sprinkler irrigation: Rating class and limiting features	Value	Drip or trickle irrigation: Rating class and limiting features	Value
W:							
Water	100	Not rated		Not Rated		Not Rated	

Table 25.--Engineering Soil Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
BcA:												
Bippus----------	0-8	Clay loam	CL	A-6	0	0	100	95-100	85-98	50-80	22-40	7-20
	8-14	Sandy clay loam, clay loam, loam	CL	A-4, A-6	0	0	100	95-100	85-98	50-80	22-40	7-20
	14-26	Sandy clay loam, loam, clay loam	CL	A-4, A-6	0	0	100	95-100	85-98	36-75	22-40	7-20
	26-49	Sandy clay loam, clay loam, loam	CL	A-4, A-6	0	0	100	95-100	85-98	36-75	22-40	7-20
	49-65	Sandy clay loam, clay loam, loam	CL	A-4, A-6	0	0	100	95-100	85-98	36-75	22-40	7-20
	65-80	Fine sandy loam, clay loam, loam, sandy clay loam	CL	A-4, A-6	0	0	100	95-100	85-98	36-75	18-40	4-20
BeD:												
Berda-----------	0-6	Loam	CL	A-6	0	0-4	88-100	86-98	75-95	36-65	24-37	9-16
	6-20	Loam, clay loam, sandy clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-22
	20-36	Clay loam, sandy clay loam, loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	36-52	Clay loam, loam, sandy clay loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	52-80	Sandy clay loam, loam, clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
BfB:												
Berwolf---------	0-11	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	97-100	70-98	15-40	13-22	NP-5
	11-20	Fine sandy loam, sandy loam	SM, SC-SM	A-2-4	0	0	100	100	65-80	25-45	20-28	3-10
	20-34	Fine sandy loam, sandy loam	SM, SC-SM	A-2-4	0	0	100	100	65-80	25-45	20-28	3-10
	34-45	Fine sandy loam, loam, loamy fine sand	SM, SC-SM, ML	A-4	0	0	100	100	75-90	15-50	15-25	1-7
	45-80	Fine sandy loam, loam, loamy fine sand	SM, SC-SM, ML	A-4	0	0	100	100	75-90	15-50	15-25	1-7

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
BP:												
Borrow pits-----	0-20	Paragravel, gravelly clay loam, gravelly loam, gravelly fine sandy loam, extremely gravelly clay loam, extremely gravelly loam, extremely gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam, very gravelly clay loam	GC, GC-GM, SC-SM, SC	A-1, A-2-4, A-2-6	0	0-10	20-80	20-75	10-45	5-30	25-44	5-25
	20-80	Paragravel, extremely gravelly loam, extremely gravelly clay loam, gravelly fine sandy loam, gravelly loam, gravelly clay loam, very gravelly fine sandy loam, very gravelly loam, very gravelly clay loam, extremely gravelly fine sandy loam	GC, GC-GM, SC-SM, SC	A-1, A-2-4, A-2-6	0	0-10	20-80	20-75	10-45	5-30	25-44	5-25
BpD:												
Berda-----------	0-6	Loam	CL	A-6	0	0-4	88-100	86-98	75-95	36-65	24-37	9-16
	6-20	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-22
	20-36	Clay loam, loam, sandy clay loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	36-52	Clay loam, sandy clay loam, loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	52-80	Sandy clay loam, loam, clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
Potter----------	0-2	Gravelly loam, gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam	ML, SC-SM, SM, CL	A-6	0	0	70-90	60-88	60-85	40-65	31-54	11-24
	2-6	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, extremely gravelly loam, very gravelly loam	GM, SC-SM	A-2-4	0	0	40-70	30-50	25-50	15-25	27-52	9-24
	6-15	Very gravelly fine sandy loam, very gravelly loam, extremely gravelly fine sandy loam, extremely gravelly loam	GC, GC-GM, SC-SM, SC	A-2-4, A-2-6	0	0	40-70	30-50	25-45	15-30	25-45	5-25
	15-29	Extremely gravelly fine sandy loam, very gravelly loam, very gravelly fine sandy loam, extremely gravelly loam	GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-50	25-45	10-40	10-25	25-44	5-25
	29-55	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam, extremely gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-40	25-40	10-40	8-20	25-44	5-25
	55-80	Extremely gravelly fine sandy loam, very gravelly loam, very gravelly fine sandy loam, extremely gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	20-40	15-40	10-30	6-10	25-44	5-25

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
BVD:												
Berda-----------	0-6	Loam	CL	A-6	0	0-4	88-100	86-98	75-95	36-65	24-37	9-16
	6-20	Loam, clay loam, sandy clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-22
	20-36	Clay loam, loam, sandy clay loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	36-52	Clay loam, loam, sandy clay loam	CL, SC	A-7-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
	52-80	Sandy clay loam, loam, clay loam	CL, SC	A-6	0	0-3	88-100	86-98	75-95	36-65	27-43	11-24
Veal------------	0-8	Fine sandy loam	CL, SC-SM, SC, CL-ML, SM	A-2-4, A-4	0	0	95-100	90-100	85-98	30-58	18-28	2-10
	8-17	Sandy clay loam, loam, clay loam	SC, CL	A-6	0	0-2	95-100	90-100	85-98	45-75	25-40	11-24
	17-36	Sandy clay loam, loam, clay loam	SC, CL	A-4, A-6	0	0-2	85-100	80-100	75-100	45-80	20-40	8-24
	36-80	Sandy clay loam, loam, clay loam	SC, CL	A-4, A-6	0	0-2	85-100	80-100	75-100	45-80	20-40	8-24
DRC:												
Drake-----------	0-5	Loam	CL, SC	A-6	0	0	98-100	96-100	85-98	30-75	21-38	5-14
	5-15	Fine sandy loam, loam, sandy clay loam, clay loam, loamy fine sand	SC, SC-SM, SM, CL-ML, CL	A-6	0	0	98-100	96-100	85-98	30-75	21-43	5-20
	15-28	Sandy clay loam, fine sandy loam, loam, clay loam	SC, CL	A-6	0	0	98-100	96-100	85-98	36-75	25-45	9-21
	28-43	Loam, clay loam, sandy clay loam, fine sandy loam	SC, CL	A-6	0	0	98-100	96-100	85-98	36-75	25-45	9-21
	43-69	Loam, fine sandy loam, sandy clay loam, clay loam	SC, CL	A-6	0	0	98-100	96-100	85-98	36-75	25-45	9-21
	69-80	Fine sandy loam, loam, sandy clay loam, clay loam	SC, CL	A-6	0	0	98-100	96-100	85-98	36-75	25-45	9-21

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
EcA:												
Estacado--------	0-6	Clay loam	CL	A-7-6	0	0	98-100	96-100	90-100	70-80	35-48	15-25
	6-19	Clay loam, sandy clay loam	CL	A-6, A-7-6	0	0	98-100	96-100	80-100	35-80	34-48	14-25
	19-38	Clay loam, sandy clay loam	CL	A-6, A-7-6	0	0	98-100	96-100	80-100	35-80	34-48	14-25
	38-50	Clay loam, sandy clay loam	CL	A-6, A-7-6	0	0	93-100	90-100	80-100	35-80	34-48	14-25
	50-80	Clay loam, sandy clay loam	CL	A-6, A-7-6	0	0	93-100	90-100	80-100	35-80	34-48	14-25
FrB:												
Friona----------	0-8	Loam	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	51-70	24-33	7-15
	8-15	Sandy clay loam, clay loam, loam	CL	A-6, A-7-6	0	0	100	100	90-100	60-75	30-45	12-25
	15-26	Sandy clay loam, loam, clay loam	CL	A-6, A-7-6	0	0	100	100	90-100	60-75	30-45	12-25
	26-31	Sandy clay loam, loam, clay loam	CL	A-6, A-7-6	0	0	100	100	90-100	60-75	30-45	12-25
	31-35	Cemented material			---	---	---	---	---	---	---	---
	35-80	Sandy clay loam, loam, clay loam	CL	A-6, A-7-6	0	0	95-100	95-100	90-100	60-75	30-45	12-25
GQE:												
Glenrio---------	0-4	Clay, silty clay, clay loam	CH, CL	A-7-6	0-2	0-5	90-100	85-100	80-100	70-95	45-60	25-38
	4-14	Clay, silty clay, clay loam	CH, CL	A-7-6	0-2	0-5	90-100	85-100	80-100	70-95	45-60	25-38
	14-60	Bedrock			---	---	---	---	---	---	---	---
Quay------------	0-3	Loam	SM, ML, CL-ML, CL	A-4, A-6	0	0	90-100	90-100	85-100	45-90	20-40	NP-20
	3-9	Loam, fine sandy loam, silt loam	SM, ML, CL-ML, CL	A-4, A-6	0	0	90-100	90-100	85-100	45-90	20-40	NP-20
	9-19	Clay loam, silt loam, loam	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	65-90	25-40	5-20
	19-26	Clay loam, sandy clay loam, silty clay loam, silty clay, clay	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	65-90	20-40	5-20
	26-36	Clay loam, sandy clay loam, clay, silty clay loam, silty clay	CL-ML, CL	A-4, A-6	0	0	100	100	90-95	75-80	20-40	5-20
	36-80	Clay loam, clay, silty clay, silty clay loam, sandy clay loam	CL-ML, CL	A-4, A-6	0	0	100	100	90-95	75-80	20-40	5-20

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
IMC:												
Ima-------------	0-5	Loamy fine sand, sandy loam, fine sandy loam	SM, SC-SM	A-2-4, A-4	0	0	90-100	90-100	90-100	25-50	15-25	NP-10
	5-10	Fine sandy loam, sandy loam, loamy fine sand	SC-SM, SM	A-2-4, A-4	0	0	90-100	90-100	90-100	25-50	20-25	NP-10
	10-32	Fine sandy loam, loamy very fine sand, sandy loam, loam	CL, SC-SM, ML, CL-ML, SM	A-2-4, A-4	0	0	90-100	90-100	90-100	30-75	20-30	2-10
	32-40	Fine sandy loam, sandy loam, loam, loamy very fine sand	CL-ML, SC-SM, ML, SM	A-2-4, A-4	0	0	90-100	90-100	90-100	30-75	20-30	2-10
	40-80	Very fine sandy loam, sandy loam, fine sandy loam	CL, SC-SM, ML, CL-ML, SM	A-2-4, A-4	0	0	90-100	90-100	90-100	30-75	20-30	2-10
Lacoca----------	0-8	Loamy fine sand, loam, fine sandy loam, sandy loam, gravelly loam, gravelly fine sandy loam, gravelly sandy loam	SM, SC-SM	A-2-4	0-2	0-5	90-100	90-100	90-100	25-50	15-25	NP-10
	8-80	Bedrock			---	---	---	---	---	---	---	---
KmB:												
Kimberson-------	0-5	Gravelly loam	CL	A-4	0	0-10	65-95	60-95	55-80	50-69	21-25	9
	5-11	Very gravelly loam, gravelly loam, gravelly fine sandy loam	GC, CL-ML, SC-SM, CL	A-2-6	0	0-10	50-90	45-85	40-60	30-55	21-40	4-14
	11-28	Cemented material			---	---	---	---	---	---	---	---
	28-64	Extremely gravelly fine sandy loam, extremely gravelly loam, extremely cobbly fine sandy loam, extremely cobbly loam	GP-GM, GC-GM, GC	A-1-a	0	0-45	15-50	10-40	8-35	3-25	15-31	NP-8
	64-80	Cemented material			---	---	---	---	---	---	---	---

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
LcA:												
Lazbuddie-------	0-4	Clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
	4-12	Clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
	12-35	Clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
	35-45	Clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
	45-69	Clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
	69-80	Clay, silty clay	CH	A-7-6	0	0	98-100	97-100	95-100	95-100	60-75	35-50
LoA:												
Lofton----------	0-9	Clay loam	CL	A-7-6	0	0	100	100	98-100	70-90	35-45	15-25
	9-24	Clay, silty clay	CH	A-7-6	0	0	100	100	95-100	70-90	38-55	20-35
	24-38	Clay, silty clay	CH	A-7-6	0	0	100	100	95-100	70-90	38-55	20-35
	38-52	Clay, clay loam, silty clay	CH	A-7-6	0	0	100	95-100	90-100	70-90	35-55	15-30
	52-80	Silty clay, clay loam, clay	CL	A-7-6	0	0	100	95-100	90-100	70-90	35-55	15-30
M-W:												
Water, miscellaneous--	---	---	---	---	---	---	---	---	---	---	---	---
McA:												
McLean----------	0-7	Clay	CH	A-7-5	0	0	100	100	89-100	86-100	62-83	36-49
	7-21	Clay	CH	A-7-6	0	0	100	100	91-100	87-100	61-81	37-49
	21-37	Clay	CH	A-7-6	0	0	100	100	89-100	86-100	61-81	37-49
	37-42	Clay	CH	A-7-6	0	0	100	100	90-100	87-100	61-81	37-49
	42-59	Clay	CH	A-7-6	0	0	100	100	90-100	87-100	61-80	37-47
	59-80	Clay	CH	A-7-6	0	0	100	100	94-100	91-100	60-75	37-43
MNA:												
Minneosa--------	0-10	Loamy fine sand	SC-SM	A-2-4	0	0	100	100	92-97	27-32	17-24	2-6
	10-44	Loamy fine sand	SC-SM, SM	A-2-4	0	0	100	100	92-97	27-32	16-24	2-6
	44-80	Sand	SP-SM	A-2-4	0	0	100	100	76-79	8-11	0-19	NP-2
MoC:												
Mobeetie--------	0-8	Fine sandy loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	8-25	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	25-41	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	41-80	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	90-100	85-100	70-95	25-55	20-27	4-10

Table 25.--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	
MoD:												
Mobeetie--------	0-7	Fine sandy loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	7-23	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	23-39	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	39-80	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	90-100	85-100	70-95	25-55	20-27	4-10
MVE:												
Mobeetie--------	0-8	Fine sandy loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	8-25	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	25-41	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	41-80	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	90-100	85-100	70-95	25-55	20-27	4-10
Veal------------	0-8	Fine sandy loam	CL, SC-SM, SC, CL-ML, SM	A-2-4, A-4	0	0	95-100	90-100	85-98	30-58	18-28	2-10
	8-17	Sandy clay loam, clay loam, loam	CL, SC	A-6	0	0-2	95-100	90-100	85-98	45-75	25-40	11-24
	17-36	Sandy clay loam, loam, clay loam	CL, SC	A-4, A-6	0	0-2	85-100	80-100	75-100	45-80	20-40	8-24
	36-80	Sandy clay loam, clay loam, loam	CL, SC	A-4, A-6	0	0-2	85-100	80-100	75-100	45-80	20-40	8-24

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
Potter----------	0-2	Gravelly loam, gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam	ML, SC-SM, SM, CL	A-6	0	0	70-90	60-88	60-85	40-65	31-54	11-24
	2-6	Extremely gravelly fine sandy loam, very gravelly loam, very gravelly fine sandy loam, extremely gravelly loam	GM, SC-SM	A-2-4	0	0	40-70	30-50	25-50	15-25	27-52	9-24
	6-15	Very gravelly fine sandy loam, very gravelly loam, extremely gravelly loam, extremely gravelly fine sandy loam	GC, GC-GM, SC-SM, SC	A-2-4, A-2-6	0	0	40-70	30-50	25-45	15-30	25-45	5-25
	15-29	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam, extremely gravelly loam	GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-50	25-45	10-40	10-25	25-44	5-25
	29-55	Extremely gravelly fine sandy loam, very gravelly loam, extremely gravelly loam, very gravelly fine sandy loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-40	25-40	10-40	8-20	25-44	5-25
	55-80	Extremely gravelly fine sandy loam, extremely gravelly loam, very gravelly loam, very gravelly fine sandy loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	20-40	15-40	10-30	6-10	25-44	5-25
OcA:												
Olton-----------	0-8	Clay loam	CL	A-7-6	0	0	95-100	95-100	85-100	55-85	33-49	15-25
	8-15	Clay loam, clay	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	38-56	19-32
	15-31	Clay loam, clay	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	40-60	21-36
	31-48	Clay loam, silty clay loam	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	40-51	18-29
	48-75	Clay loam, silty clay loam	CL	A-6	0	0	95-100	85-100	80-100	60-90	39-50	12-29
	75-80	Clay loam, silty clay loam	CL	A-6	0	0	90-100	85-100	80-100	60-90	37-50	12-29

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
OcB:												
Olton-----------	0-7	Clay loam	CL	A-7-6	0	0	95-100	95-100	85-100	55-85	33-49	15-25
	7-13	Clay loam, clay	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	38-56	19-32
	13-29	Clay loam, clay	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	40-60	21-36
	29-46	Clay loam, silty clay loam	CL	A-7-6	0	0	95-100	90-100	90-100	65-95	40-51	18-29
	46-73	Clay loam, silty clay loam	CL	A-6	0	0	95-100	85-100	80-100	60-90	39-50	12-29
	73-80	Clay loam, silty clay loam	CL	A-6	0	0	90-100	85-100	80-100	60-90	37-50	12-29
PcA:												
Pep-------------	0-10	Clay loam	CL	A-7-6	0	0	100	95-100	90-100	70-80	37-48	16-25
	10-16	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	16-32	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	32-80	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-70	26-48	8-25
PcB:												
Pep-------------	0-9	Clay loam	CL	A-7-6	0	0	100	95-100	90-100	70-80	37-48	16-25
	9-15	Clay loam, loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	15-31	Clay loam, loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	31-80	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-70	26-48	8-25
PcC:												
Pep-------------	0-8	Clay loam	CL	A-7-6	0	0	100	95-100	90-100	70-80	37-48	16-25
	8-14	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	14-30	Clay loam, loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	60-80	26-48	8-25
	30-80	Clay loam, sandy clay loam, loam	CL	A-6	0	0	100	95-100	90-100	60-70	26-48	8-25

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
PGE:												
Potter----------	0-2	Gravelly loam, very gravelly fine sandy loam, very gravelly loam, gravelly fine sandy loam	ML, SC-SM, SM, CL	A-6	0	0	70-90	60-88	60-85	40-65	31-54	11-24
	2-6	Extremely gravelly fine sandy loam, extremely gravelly loam, very gravelly loam, very gravelly fine sandy loam	GM, SC-SM	A-2-4	0	0	40-70	30-50	25-50	15-25	27-52	9-24
	6-15	Very gravelly fine sandy loam, very gravelly loam, extremely gravelly fine sandy loam, extremely gravelly loam	GC, GC-GM, SC-SM, SC	A-2-4, A-2-6	0	0	40-70	30-50	25-45	15-30	25-45	5-25
	15-29	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam, extremely gravelly loam	GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-50	25-45	10-40	10-25	25-44	5-25
	29-55	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly loam, extremely gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-40	25-40	10-40	8-20	25-44	5-25
	55-80	Extremely gravelly fine sandy loam, very gravelly loam, very gravelly fine sandy loam, extremely gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	20-40	15-40	10-30	6-10	25-44	5-25

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
PMG:												
Potter----------	0-2	Gravelly loam, very gravelly loam, very gravelly fine sandy loam, gravelly fine sandy loam	ML, SC-SM, SM, CL	A-6	0	0	70-90	60-88	60-85	40-65	31-54	11-24
	2-6	Extremely gravelly fine sandy loam, very gravelly fine sandy loam, extremely gravelly loam, very gravelly loam	GM, SC-SM	A-2-4	0	0	40-70	30-50	25-50	15-25	27-52	9-24
	6-15	Very gravelly fine sandy loam, extremely gravelly loam, extremely gravelly fine sandy loam, very gravelly loam	GC, GC-GM, SC-SM, SC	A-2-4, A-2-6	0	0	40-70	30-50	25-45	15-30	25-45	5-25
	15-29	Extremely gravelly fine sandy loam, extremely gravelly loam, very gravelly fine sandy loam, very gravelly loam	GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-50	25-45	10-40	10-25	25-44	5-25
	29-55	Extremely gravelly fine sandy loam, extremely gravelly loam, very gravelly fine sandy loam, very gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	30-40	25-40	10-40	8-20	25-44	5-25
	55-80	Extremely gravelly fine sandy loam, extremely gravelly loam, very gravelly fine sandy loam, very gravelly loam	GP-GC, GC-GM	A-1, A-2-4, A-2-6	0	0	20-40	15-40	10-30	6-10	25-44	5-25
Mobeetie--------	0-8	Fine sandy loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	8-25	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	25-41	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	95-100	90-100	75-95	25-55	20-27	4-10
	41-80	Fine sandy loam, loam	SC-SM, SC, CL-ML	A-2-4, A-4	0	0-5	90-100	85-100	70-95	25-55	20-27	4-10

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
PnC:												
Plemons---------	0-6	Loam	CL	A-6	0	0	98-100	96-100	90-100	65-90	19-39	2-16
	6-13	Clay loam, loam, sandy clay loam	CL	A-6	0	0	98-100	96-100	90-100	70-90	30-46	12-21
	13-35	Clay loam, sandy clay loam	CL	A-6	0	0	98-100	96-100	90-100	70-90	30-46	12-21
	35-58	Clay loam, sandy clay loam	CL	A-7-6	0	0	95-100	92-100	90-100	70-90	31-47	13-28
	58-76	Clay loam, sandy clay loam	SC-SM, CL	A-7-6	0	0	95-100	92-100	90-100	75-90	31-48	13-28
	76-80	Clay, clay loam	CL, CH	A-7-6	0	0	95-100	92-100	90-100	75-90	38-62	19-37
PrA:												
Portales--------	0-15	Clay loam	CL	A-7-6	0	0	100	95-100	90-100	70-80	37-48	16-25
	15-35	Clay loam, loam	CL	A-7-6	0	0	100	95-100	90-100	60-80	28-48	9-25
	35-43	Loam, clay loam	CL	A-6	0	0	100	95-100	90-100	60-70	28-48	9-25
	43-60	Clay loam, loam	CL	A-7-6	0	0	100	95-100	90-100	60-80	28-48	9-25
	60-80	Clay loam, loam	CL	A-7-6	0	0	100	95-100	90-100	60-80	28-48	9-25
PuA:												
Pullman---------	0-5	Clay loam	CL	A-7-6	0	0	100	100	95-100	70-95	39-56	19-29
	5-18	Clay	CH	A-7-6	0	0	100	100	95-100	85-98	51-68	29-40
	18-33	Clay, silty clay	CL, CH	A-7-6	0	0	100	100	95-100	75-98	48-61	28-37
	33-52	Clay, silty clay loam, silty clay, clay loam	CH, CL	A-7-6	0	0	95-100	90-100	80-100	75-95	44-60	25-36
	52-66	Clay, clay loam, silty clay, silty clay loam	CL	A-7-6	0	0	95-100	90-100	80-100	75-95	43-59	20-36
	66-80	Clay loam, silty clay loam, silty clay, clay	CL	A-6	0	0	95-100	90-100	80-100	75-95	30-50	15-30
PuB:												
Pullman---------	0-4	Clay loam	CL	A-7-6	0	0	100	100	95-100	70-95	39-56	19-29
	4-17	Clay	CH	A-7-6	0	0	100	100	95-100	85-98	51-68	29-40
	17-32	Clay, silty clay	CL, CH	A-7-6	0	0	100	100	95-100	75-98	48-61	28-37
	32-51	Clay, silty clay, clay loam, silty clay loam	CH, CL	A-7-6	0	0	95-100	90-100	80-100	75-95	44-60	25-36
	51-65	Clay, silty clay loam, silty clay, clay loam	CL	A-7-6	0	0	95-100	90-100	80-100	75-95	43-59	20-36
	65-80	Clay loam, silty clay loam, clay, silty clay	CL	A-6	0	0	95-100	90-100	80-100	75-95	30-50	15-30

Table 25.--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	
PxA:												
Pantex----------	0-7	Silty clay loam	CL	A-7-6	0	0	100	100	95-100	70-95	40-58	19-29
	7-20	Silty clay, clay, silty clay loam	CH, CL	A-7-6	0	0	100	100	95-100	85-98	47-69	25-40
	20-34	Silty clay, clay, silty clay loam	CH, CL	A-7-6	0	0	100	100	90-100	85-98	47-69	25-40
	34-49	Silty clay loam, silty clay, clay	CL, CH	A-7-6	0	0	100	100	95-100	75-98	45-66	25-40
	49-71	Silty clay loam, silty clay, clay	CL, CH	A-7-6	0	0	100	100	95-100	75-98	45-66	25-40
	71-80	Silty clay loam, clay loam, silty clay	CL	A-7-6	0	0	95-100	90-100	80-100	75-95	40-57	15-33
QcB:												
Quay------------	0-3	Loam	SM, ML, CL-ML, CL	A-4, A-6	0	0	90-100	90-100	85-100	45-90	20-40	NP-20
	3-9	Loam, silt loam, fine sandy loam	SM, ML, CL-ML, CL	A-4, A-6	0	0	90-100	90-100	85-100	45-90	20-40	NP-20
	9-19	Clay loam, loam, silt loam	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	65-90	25-40	5-20
	19-26	Clay loam, silty clay loam, sandy clay loam, silty clay, clay	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	65-90	20-40	5-20
	26-36	Clay loam, sandy clay loam, silty clay loam, clay, silty clay	CL-ML, CL	A-4, A-6	0	0	100	100	90-95	75-80	20-40	5-20
	36-80	Clay loam, clay, silty clay, silty clay loam, sandy clay loam	CL-ML, CL	A-4, A-6	0	0	100	100	90-95	75-80	20-40	5-20
RaA:												
Randall---------	0-3	Clay	CH	A-7-5	0	0	100	100	89-100	82-100	62-90	36-53
	3-9	Clay, silty clay	CH	A-7-6	0	0	100	100	86-100	79-99	61-88	37-53
	9-17	Clay, silty clay	CH	A-7-6	0	0	100	100	86-100	79-99	61-88	37-53
	17-38	Clay, silty clay	CH	A-7-5	0	0	100	100	85-100	79-99	60-88	37-53
	38-62	Clay	CH	A-7-5	0	0	100	100	84-100	78-98	60-87	37-54
	62-80	Clay	CH	A-7-6	0	0	100	100	85-100	79-99	60-87	37-54

Table 25.--Engineering Soil Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
RfC:												
Redona	0-10	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	100	80-90	30-50	20-30	NP-10
	10-24	Sandy clay loam, clay loam, loam	SC, CL	A-6	0	0	100	100	80-100	35-55	30-40	10-20
	24-28	Sandy clay loam, loam, clay loam	SC, CL	A-6	0	0	100	100	80-100	35-55	30-40	10-20
	28-50	Clay loam, loam, sandy clay loam	SC, CL	A-6	0	0	100	100	80-100	35-55	30-40	10-20
	50-80	Clay loam, sandy clay loam, loam	SC, CL	A-6	0	0	100	100	80-100	35-55	30-40	10-20
TuA:												
Tucumcari	0-5	Clay loam	CL	A-6	0	0	100	100	75-95	50-85	34-40	14-20
	5-16	Clay, clay loam, silty clay, silty clay loam, sandy clay loam	CL, CH	A-7-6	0	0	100	100	90-100	60-90	40-55	20-30
	16-30	Clay, silty clay, silty clay loam, sandy clay loam, clay loam	CL, CH	A-7-6	0	0	100	100	90-100	60-90	40-55	20-30
	30-45	Clay, clay loam, sandy clay loam, silty clay loam, silty clay	CL, CH	A-7-6	0	0	100	100	90-100	60-90	40-55	20-30
	45-80	Clay loam, sandy clay loam	CL	A-7-6	0	0	100	100	90-100	60-80	35-50	15-25
W:												
Water	---	---	---	---	---	---	---	---	---	---	---	---

Table 26.--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	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
BcA:														
Bippus--------------	0-8	25-70	10-45	15-35	1.40-1.60	0.6-2	0.14-0.20	0.5-2.0	1.5-3.0	.28	.28	5	6	48
	8-14	25-70	10-45	15-35	1.40-1.60	0.6-2	0.12-0.20	0.5-2.0	0.5-1.5	.32	.32			
	14-26	25-70	10-45	20-35	1.40-1.65	0.6-2	0.12-0.20	1.0-3.0	0.1-0.5	.32	.32			
	26-49	25-70	10-45	20-35	1.40-1.65	0.6-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	49-65	25-70	10-45	20-35	1.40-1.65	0.6-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	65-80	25-80	10-45	10-35	1.40-1.65	0.6-2	0.10-0.18	1.0-2.0	0.1-0.5	.24	.24			
BeD:														
Berda---------------	0-6	25-55	20-45	15-27	1.35-1.50	0.6-2	0.10-0.17	0.0-2.9	0.1-1.0	.28	.28	5	4L	86
	6-20	25-70	10-45	18-35	1.40-1.55	0.6-2	0.10-0.17	0.0-2.9	0.1-0.5	.37	.37			
	20-36	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	36-52	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	52-80	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
BfB:														
Berwolf-------------	0-11	75-88	5-20	3-12	1.35-1.60	6-20	0.07-0.15	0.0-1.5	0.5-1.5	.17	.17	5	2	134
	11-20	55-85	5-30	10-18	1.40-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	20-34	55-85	5-30	10-18	1.40-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	34-45	35-85	5-40	7-15	1.40-1.50	2-6	0.07-0.18	0.0-2.9	0.1-0.5	.24	.24			
	45-80	35-85	5-40	7-15	1.40-1.50	2-6	0.06-0.17	0.0-2.9	0.1-0.5	.24	.24			
BP:														
Pits, borrow--------	0-20	30-75	10-40	15-35	1.40-1.65	0.06-2	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32	1	8	0
	20-80	30-75	10-40	15-35	1.40-1.65	0.06-2	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
BpD:														
Berda---------------	0-6	25-55	20-45	15-27	1.35-1.50	0.6-2	0.10-0.17	0.0-2.9	0.1-1.0	.28	.28	5	4L	86
	6-20	25-70	10-45	18-35	1.40-1.55	0.6-2	0.10-0.17	0.0-2.9	0.1-0.5	.37	.37			
	20-36	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	36-52	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	52-80	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
Potter--------------	0-2	30-75	10-40	18-35	1.35-1.60	0.6-2	0.08-0.17	0.0-2.9	2.0-5.0	.15	.32	1	8	0
	2-6	30-75	10-40	15-35	1.35-1.60	0.6-2	0.04-0.16	0.0-2.9	1.0-4.0	.15	.32			
	6-15	30-75	10-40	15-35	1.40-1.65	0.6-2	0.04-0.15	0.0-2.9	0.4-1.0	.10	.32			
	15-29	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	29-55	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	55-80	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
BVD:														
Berda----------------	0-6	25-55	20-45	15-27	1.35-1.50	0.6-2	0.10-0.17	0.0-2.9	0.1-1.0	.28	.28	5	4L	86
	6-20	25-70	10-45	18-35	1.40-1.55	0.6-2	0.10-0.17	0.0-2.9	0.1-0.5	.37	.37			
	20-36	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	36-52	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	52-80	25-70	10-45	18-35	1.40-1.55	0.6-2	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
Veal-----------------	0-8	30-80	10-40	10-20	1.35-1.50	0.6-2	0.10-0.16	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	8-17	30-70	10-40	20-35	1.40-1.55	0.6-2	0.10-0.15	0.0-2.9	0.1-0.5	.28	.28			
	17-36	30-70	10-40	20-35	1.45-1.60	0.6-2	0.08-0.14	0.0-2.9	0.1-0.5	.28	.28			
	36-80	30-70	10-40	20-35	1.45-1.60	0.6-2	0.08-0.14	0.0-2.9	0.1-0.5	.28	.28			
DRC:														
Drake----------------	0-5	25-85	10-40	10-27	1.30-1.55	0.6-2	0.07-0.16	0.0-2.9	0.5-1.5	.28	.28	4	4L	86
	5-15	25-85	10-40	10-35	1.60-1.65	0.6-2	0.10-0.16	0.0-3.0	0.5-1.0	.32	.32			
	15-28	30-65	10-48	15-40	1.60-1.65	0.6-2	0.10-0.16	1.0-3.0	0.1-0.5	.32	.32			
	28-43	30-65	10-48	15-40	1.60-1.65	0.6-2	0.10-0.16	1.0-3.0	0.1-0.5	.32	.32			
	43-69	30-65	10-48	15-40	1.60-1.65	0.6-2	0.10-0.16	1.0-3.0	0.1-0.5	.32	.32			
	69-80	30-65	10-48	15-40	1.60-1.65	0.6-2	0.10-0.16	1.0-3.0	0.1-0.5	.32	.32			
EcA:														
Estacado-------------	0-6	25-45	15-45	28-40	1.30-1.60	0.6-2	0.12-0.18	3.0-5.9	1.0-3.0	.32	.32	5	5	56
	6-19	25-65	10-45	20-40	1.35-1.55	0.6-2	0.11-0.18	3.0-5.9	0.5-1.0	.32	.32			
	19-38	25-65	10-45	20-40	1.35-1.55	0.6-2	0.11-0.18	3.0-5.9	0.1-0.5	.32	.32			
	38-50	25-65	10-45	20-40	1.40-1.60	0.6-2	0.10-0.17	3.0-5.9	0.1-0.5	.32	.32			
	50-80	25-65	10-45	20-40	1.40-1.60	0.6-2	0.10-0.17	3.0-5.9	0.1-0.5	.32	.32			
FrB:														
Friona---------------	0-8	30-50	30-45	15-27	1.25-1.50	0.6-2	0.12-0.18	0.0-2.9	1.0-2.0	.28	.28	3	5	56
	8-15	30-65	5-40	20-35	1.40-1.60	0.6-2	0.13-0.18	0.0-2.9	0.5-1.0	.32	.32			
	15-26	30-65	5-40	20-35	1.40-1.60	0.6-2	0.12-0.18	0.0-2.9	0.1-0.5	.32	.32			
	26-31	30-65	5-40	20-35	1.40-1.60	0.6-2	0.12-0.18	0.0-2.9	0.1-0.5	.32	.32			
	31-35	---	---	---	---	0.00-0.2	---	---	---	---	---			
	35-80	30-65	5-40	20-35	1.50-1.70	0.6-2	0.07-0.15	0.0-2.9	0.1-0.5	.32	.32			
GQE:														
Glenrio--------------	0-4	5-35	15-50	35-55	1.30-1.45	0.06-0.2	0.12-0.20	6.0-8.9	0.1-1.0	.32	.32	1	4	86
	4-14	5-35	15-50	35-55	1.30-1.45	0.06-0.2	0.12-0.18	6.0-8.9	0.1-1.0	.37	.37			
	14-60	---	---	---	---	0.00-0.06	---	---	---	---	---			
Quay-----------------	0-3	25-50	30-50	8-27	1.45-1.55	0.6-6	0.11-0.20	2.0-4.0	0.5-1.0	.37	.37	5	4L	86
	3-9	20-70	20-70	8-27	1.45-1.55	0.6-6	0.11-0.20	2.5-4.0	0.1-0.5	.37	.37			
	9-19	20-40	30-70	18-35	1.40-1.55	0.2-2	0.15-0.20	2.5-4.0	0.1-0.5	.32	.32			
	19-26	5-65	10-70	20-50	1.40-1.55	0.2-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	26-36	5-65	10-70	20-50	1.40-1.60	0.2-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	36-80	5-65	10-70	20-50	1.40-1.70	0.2-2	0.12-0.14	1.5-4.0	0.1-0.5	.32	.32			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
IMC:														
Ima-----------------	0-5	50-85	5-25	5-20	1.35-1.55	2-20	0.07-0.15	0.0-2.9	0.5-1.0	.20	.20	5	2	134
	5-10	50-85	5-25	5-20	1.35-1.50	2-20	0.07-0.15	0.0-2.9	0.1-0.5	.24	.24			
	10-32	40-80	10-35	5-20	1.35-1.50	2-6	0.09-0.18	0.0-2.9	0.1-0.5	.24	.24			
	32-40	40-80	10-35	5-20	1.50-1.65	2-6	0.09-0.18	0.0-2.9	0.1-0.5	.24	.24			
	40-80	55-70	15-35	5-20	1.50-1.60	2-20	0.09-0.18	0.0-2.9	0.1-0.5	.32	.32			
Lacoca--------------	0-8	50-85	5-30	5-20	1.35-1.55	2-20	0.07-0.15	0.0-2.9	0.1-1.0	.17	.17	1	2	134
	8-80	---	---	---	---	0.00-0.06	---	---	---	---	---			
KmB:														
Kimberson-----------	0-5	35-70	20-45	15-20	1.35-1.45	0.6-2	0.08-0.18	0.0-2.9	1.0-3.0	.20	.37	1	5	56
	5-11	35-75	20-45	10-27	1.35-1.45	0.6-2	0.07-0.18	0.0-2.9	1.0-3.0	.10	.37			
	11-28	---	---	---	---	0.00-0.06	---	---	---	---	---			
	28-64	35-75	15-45	10-25	1.35-1.45	0.2-2	0.05-0.11	0.0-2.9	0.1-0.8	.02	.32			
	64-80	---	---	---	---	0.00-0.06	---	---	---	---	---			
LcA:														
Lazbuddie-----------	0-4	2-20	20-40	55-65	1.20-1.35	0.00-0.06	0.12-0.18	9.0-18.0	1.0-2.0	.32	.32	5	7	38
	4-12	2-20	20-40	55-65	1.20-1.35	0.00-0.06	0.12-0.18	9.0-18.0	0.5-1.0	.32	.32			
	12-35	2-20	20-40	55-70	1.20-1.35	0.00-0.06	0.12-0.18	9.0-18.0	0.1-0.5	.32	.32			
	35-45	1-20	20-40	55-70	1.20-1.35	0.00-0.06	0.11-0.18	9.0-18.0	0.1-0.5	.32	.32			
	45-69	1-10	20-40	65-75	1.20-1.35	0.00-0.06	0.11-0.18	9.0-18.0	0.1-0.5	.32	.32			
	69-80	0-10	18-45	55-75	1.00-1.30	0.00-0.06	0.11-0.18	9.0-18.0	0.1-0.5	.32	.32			
LoA:														
Lofton--------------	0-9	15-40	20-50	30-40	1.20-1.40	0.2-0.6	0.14-0.20	3.0-5.9	1.5-3.0	.32	.32	5	6	48
	9-24	15-35	20-50	40-50	1.25-1.45	0.00-0.06	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	24-38	15-35	20-50	40-50	1.25-1.45	0.00-0.06	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	38-52	15-35	20-50	30-50	1.30-1.50	0.06-0.2	0.12-0.18	3.0-5.9	0.1-0.5	.32	.32			
	52-80	5-25	30-55	30-50	1.30-1.50	0.06-0.2	0.10-0.16	3.0-5.9	0.1-0.5	.32	.32			
M-W:														
Water, miscellaneous	---	---	---	---	---	---	---	---	---	---	---	-	---	---
McA:														
McLean--------------	0-7	3-15	20-40	50-65	1.00-1.30	0.00-0.06	0.12-0.18	9.0-20.0	1.0-2.0	.32	.32	5	7	38
	7-21	3-15	20-40	50-65	1.00-1.30	0.00-0.06	0.12-0.18	9.0-20.0	0.5-1.0	.32	.32			
	21-37	3-15	20-40	50-65	1.00-1.30	0.00-0.06	0.11-0.18	9.0-20.0	0.5-1.0	.32	.32			
	37-42	3-15	20-40	50-65	1.00-1.30	0.00-0.06	0.11-0.18	9.0-20.0	0.5-1.0	.32	.32			
	42-59	3-15	20-40	50-65	1.00-1.30	0.00-0.06	0.11-0.18	9.0-20.0	0.5-1.0	.32	.32			
	59-80	3-15	20-40	50-60	1.00-1.30	0.00-0.06	0.11-0.17	9.0-20.0	0.1-0.5	.32	.32			
MNA:														
Minneosa------------	0-10	---	---	5-10	1.40-1.50	6-20	0.09-0.10	0.0-2.9	0.5-0.9	.20	.20	5	2	134
	10-44	---	---	5-10	1.50-1.60	2-6	0.09-0.10	0.0-2.9	0.0-0.8	.20	.20			
	44-80	---	---	2-5	1.50-1.60	20-29	0.05-0.07	0.0-2.9	0.0-0.8	.10	.10			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
MoC:														
Mobeetie------------	0-8	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.17	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	8-25	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	25-41	45-75	15-35	10-18	1.35-1.50	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
	41-80	45-75	15-35	10-18	1.40-1.55	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
MoD:														
Mobeetie------------	0-7	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.17	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	7-23	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	23-39	45-75	15-35	10-18	1.35-1.50	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
	39-80	45-75	15-35	10-18	1.40-1.55	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
MVE:														
Mobeetie------------	0-8	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.17	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	8-25	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	25-41	45-75	15-35	10-18	1.35-1.50	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
	41-80	45-75	15-35	10-18	1.40-1.55	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
Veal----------------	0-8	30-80	10-40	10-20	1.35-1.50	0.6-2	0.10-0.16	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	8-17	30-70	10-40	20-35	1.40-1.55	0.6-2	0.10-0.15	0.0-2.9	0.1-0.5	.28	.28			
	17-36	30-70	10-40	20-35	1.45-1.60	0.6-2	0.08-0.14	0.0-2.9	0.1-0.5	.28	.28			
	36-80	30-70	10-40	20-35	1.45-1.60	0.6-2	0.08-0.14	0.0-2.9	0.1-0.5	.28	.28			
Potter--------------	0-2	30-75	10-40	18-35	1.35-1.60	0.6-2	0.08-0.17	0.0-2.9	2.0-5.0	.15	.32	1	8	0
	2-6	30-75	10-40	15-35	1.35-1.60	0.6-2	0.04-0.16	0.0-2.9	1.0-4.0	.15	.32			
	6-15	30-75	10-40	15-35	1.40-1.65	0.6-2	0.04-0.15	0.0-2.9	0.4-1.0	.10	.32			
	15-29	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	29-55	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	55-80	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
OcA:														
Olton---------------	0-8	25-45	25-45	22-35	1.25-1.55	0.6-2	0.14-0.20	3.0-5.9	1.0-2.5	.32	.32	5	6	48
	8-15	25-45	25-45	28-45	1.25-1.55	0.2-0.6	0.11-0.18	3.0-5.9	0.5-1.0	.32	.32			
	15-31	25-45	25-45	30-50	1.25-1.55	0.2-0.6	0.11-0.18	3.0-5.9	0.5-1.0	.32	.32			
	31-48	10-45	25-60	30-40	1.25-1.55	0.2-0.6	0.12-0.18	3.0-5.9	0.5-1.0	.32	.32			
	48-75	10-45	25-60	30-40	1.35-1.65	0.2-0.6	0.10-0.18	3.0-5.9	0.1-0.5	.32	.32			
	75-80	10-45	25-60	27-40	1.35-1.65	0.2-0.6	0.10-0.18	3.0-5.9	0.1-0.5	.32	.32			
OcB:														
Olton---------------	0-7	25-45	25-45	22-35	1.25-1.55	0.6-2	0.14-0.20	3.0-5.9	1.0-2.5	.32	.32	5	6	48
	7-13	25-45	25-45	28-45	1.25-1.55	0.2-0.6	0.11-0.18	3.0-5.9	0.5-1.0	.32	.32			
	13-29	25-45	25-45	30-50	1.25-1.55	0.2-0.6	0.11-0.18	3.0-5.9	0.5-1.0	.32	.32			
	29-46	10-45	25-60	30-40	1.25-1.55	0.2-0.6	0.12-0.18	3.0-5.9	0.5-1.0	.32	.32			
	46-73	10-45	25-60	30-40	1.35-1.65	0.2-0.6	0.10-0.18	3.0-5.9	0.1-0.5	.32	.32			
	73-80	10-45	25-60	27-40	1.35-1.65	0.2-0.6	0.10-0.18	3.0-5.9	0.1-0.5	.32	.32			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
PcA:														
Pep-----------------	0-10	25-45	25-45	27-40	1.30-1.60	0.6-2	0.12-0.18	0.5-5.9	1.0-2.5	.32	.32	4	4L	86
	10-16	20-65	25-60	18-35	1.40-1.70	0.6-2	0.11-0.18	0.5-5.9	0.5-1.0	.32	.32			
	16-32	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.17	0.5-5.9	0.1-0.5	.32	.32			
	32-80	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.15	0.5-5.9	0.1-0.5	.32	.32			
PcB:														
Pep-----------------	0-9	25-45	25-45	27-40	1.30-1.60	0.6-2	0.12-0.18	0.5-5.9	1.0-2.5	.32	.32	4	4L	86
	9-15	20-65	25-60	18-35	1.40-1.70	0.6-2	0.11-0.18	0.5-5.9	0.5-1.0	.32	.32			
	15-31	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.17	0.5-5.9	0.1-0.5	.32	.32			
	31-80	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.15	0.5-5.9	0.1-0.5	.32	.32			
PcC:														
Pep-----------------	0-8	25-45	25-45	27-40	1.30-1.60	0.6-2	0.12-0.18	0.5-5.9	1.0-2.5	.32	.32	4	4L	86
	8-14	20-65	25-60	18-35	1.40-1.70	0.6-2	0.11-0.18	0.5-5.9	0.5-1.0	.32	.32			
	14-30	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.17	0.5-5.9	0.1-0.5	.32	.32			
	30-80	20-65	25-60	18-35	1.40-1.70	0.6-2	0.10-0.15	0.5-5.9	0.1-0.5	.32	.32			
PGE:														
Potter--------------	0-2	30-75	10-40	18-35	1.35-1.60	0.6-2	0.08-0.17	0.0-2.9	2.0-5.0	.15	.32	1	8	0
	2-6	30-75	10-40	15-35	1.35-1.60	0.6-2	0.04-0.16	0.0-2.9	1.0-4.0	.15	.32			
	6-15	30-75	10-40	15-35	1.40-1.65	0.6-2	0.04-0.15	0.0-2.9	0.4-1.0	.10	.32			
	15-29	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	29-55	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	55-80	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
PMG:														
Potter--------------	0-2	30-75	10-40	18-35	1.35-1.60	0.6-2	0.08-0.17	0.0-2.9	2.0-5.0	.15	.32	1	8	0
	2-6	30-75	10-40	15-35	1.35-1.60	0.6-2	0.04-0.16	0.0-2.9	1.0-4.0	.15	.32			
	6-15	30-75	10-40	15-35	1.40-1.65	0.6-2	0.04-0.15	0.0-2.9	0.4-1.0	.10	.32			
	15-29	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	29-55	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
	55-80	30-75	10-40	15-35	1.40-1.65	0.06-0.6	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
Mobeetie------------	0-8	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.17	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	8-25	45-75	15-35	10-18	1.35-1.50	2-6	0.10-0.15	0.0-2.9	0.1-0.5	.24	.24			
	25-41	45-75	15-35	10-18	1.35-1.50	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
	41-80	45-75	15-35	10-18	1.40-1.55	2-6	0.09-0.15	0.0-2.9	0.1-0.5	.24	.24			
PnC:														
Plemons-------------	0-6	30-50	35-50	5-26	1.30-1.55	0.6-2	0.14-0.18	2.0-4.0	1.0-2.0	.37	.37	4	4L	86
	6-13	20-65	25-50	20-40	1.20-1.45	0.6-2	0.10-0.18	2.0-4.0	0.5-0.8	.32	.32			
	13-35	20-65	25-50	20-40	1.20-1.50	0.6-2	0.10-0.18	2.0-4.0	0.3-0.6	.32	.32			
	35-58	20-65	25-50	20-40	1.30-1.55	0.6-2	0.12-0.18	2.5-4.5	0.3-0.6	.32	.32			
	58-76	20-65	25-50	20-40	1.30-1.55	0.6-2	0.12-0.18	3.0-5.5	0.3-0.6	.32	.32			
	76-80	10-40	25-40	28-55	1.20-1.45	0.06-2	0.12-0.18	3.0-5.5	0.3-0.5	.28	.28			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
PrA:														
Portales------------	0-15	25-45	25-45	27-40	1.30-1.60	0.6-2	0.12-0.18	0.5-5.9	1.0-2.5	.32	.32	4	4	86
	15-35	30-45	25-40	18-35	1.40-1.50	0.6-2	0.11-0.18	0.5-5.9	1.0-2.0	.32	.32			
	35-43	30-45	25-40	18-35	1.40-1.50	0.6-2	0.10-0.17	0.5-5.9	0.1-0.3	.37	.37			
	43-60	30-45	25-40	18-35	1.40-1.50	0.6-2	0.10-0.15	0.5-5.9	0.1-0.3	.32	.32			
	60-80	30-45	25-40	18-35	1.40-1.50	0.6-2	0.10-0.15	0.5-5.9	0.1-0.3	.32	.32			
PuA:														
Pullman-------------	0-5	20-40	25-45	27-40	1.25-1.40	0.2-0.6	0.15-0.20	3.0-6.9	1.5-3.0	.32	.32	5	6	48
	5-18	10-35	25-50	40-55	1.30-1.55	0.06-0.2	0.12-0.18	6.4-9.5	0.5-2.0	.32	.32			
	18-33	10-35	25-50	40-50	1.25-1.55	0.06-0.2	0.12-0.18	3.6-9.9	0.1-0.5	.32	.32			
	33-52	10-35	25-60	35-50	1.28-1.60	0.06-0.2	0.12-0.20	3.0-7.9	0.1-0.5	.32	.32			
	52-66	10-35	25-60	35-50	1.28-1.60	0.2-0.6	0.12-0.20	2.0-5.9	0.1-0.5	.32	.32			
	66-80	10-35	25-60	35-50	1.28-1.60	0.06-0.2	0.10-0.20	1.7-3.8	0.1-0.5	.37	.37			
PuB:														
Pullman-------------	0-4	20-40	25-45	27-40	1.25-1.40	0.2-0.6	0.15-0.20	3.0-6.9	1.5-3.0	.32	.32	5	6	48
	4-17	10-35	25-50	40-55	1.30-1.55	0.06-0.2	0.12-0.18	6.4-9.5	0.5-2.0	.32	.32			
	17-32	10-35	25-50	40-50	1.25-1.55	0.06-0.2	0.12-0.18	3.6-9.9	0.1-0.5	.32	.32			
	32-51	10-35	25-60	35-50	1.28-1.60	0.06-0.2	0.12-0.20	3.0-7.9	0.1-0.5	.32	.32			
	51-65	10-35	25-60	35-50	1.28-1.60	0.2-0.6	0.12-0.20	2.0-5.9	0.1-0.5	.32	.32			
	65-80	10-35	25-60	35-50	1.28-1.60	0.06-0.2	0.10-0.20	1.7-3.8	0.1-0.5	.37	.37			
PxA:														
Pantex--------------	0-7	5-20	45-55	27-40	1.25-1.50	0.2-0.6	0.12-0.22	5.0-10.0	1.5-3.0	.37	.37	5	7	38
	7-20	5-20	30-55	35-55	1.25-1.50	0.06-0.2	0.12-0.22	6.0-10.0	1.0-2.0	.32	.32			
	20-34	5-20	30-55	35-55	1.25-1.50	0.06-0.2	0.12-0.22	6.0-10.0	1.0-2.0	.32	.32			
	34-49	5-25	30-55	35-55	1.25-1.50	0.06-0.6	0.12-0.22	6.0-10.0	0.1-0.5	.37	.37			
	49-71	5-25	30-55	35-55	1.25-1.50	0.06-0.6	0.12-0.22	6.0-10.0	0.1-0.5	.37	.37			
	71-80	5-25	30-55	35-45	1.25-1.50	0.2-0.6	0.12-0.20	6.0-10.0	0.1-0.5	.37	.37			
QcB:														
Quay----------------	0-3	25-50	30-50	8-27	1.45-1.55	0.6-6	0.11-0.20	2.0-4.0	0.5-1.0	.37	.37	5	4L	86
	3-9	20-70	20-70	8-27	1.45-1.55	0.6-6	0.11-0.20	2.5-4.0	0.1-0.5	.37	.37			
	9-19	20-40	30-70	18-35	1.40-1.55	0.2-2	0.15-0.20	2.5-4.0	0.1-0.5	.32	.32			
	19-26	5-65	10-70	20-50	1.40-1.55	0.2-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	26-36	5-65	10-70	20-50	1.40-1.60	0.2-2	0.12-0.20	1.5-4.0	0.1-0.5	.32	.32			
	36-80	5-65	10-70	20-50	1.40-1.70	0.2-2	0.12-0.14	1.5-4.0	0.1-0.5	.32	.32			
RaA:														
Randall-------------	0-3	5-25	15-40	50-70	1.15-1.35	0.00-0.06	0.12-0.18	9.0-25.0	1.5-2.5	.32	.32	5	7	38
	3-9	5-25	15-40	50-70	1.15-1.35	0.00-0.06	0.12-0.18	9.0-25.0	0.5-1.0	.32	.32			
	9-17	5-25	15-40	50-70	1.15-1.35	0.06-0.2	0.11-0.18	9.0-25.0	0.5-1.0	.32	.32			
	17-38	5-25	15-40	50-70	1.15-1.35	0.06-0.2	0.11-0.18	9.0-25.0	0.1-1.0	.32	.32			
	38-62	5-25	15-40	50-70	1.15-1.35	0.06-0.2	0.11-0.18	9.0-25.0	0.1-0.5	.32	.32			
	62-80	5-25	15-40	50-70	1.15-1.35	0.06-0.2	0.11-0.17	9.0-25.0	0.1-0.5	.32	.32			

Table 26.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
RfC:														
Redona--------------	0-10	55-75	10-40	10-20	1.35-1.55	2-6	0.09-0.18	0.0-2.9	1.0-2.0	.28	.28	5	3	86
	10-24	25-65	10-40	18-35	1.40-1.55	0.6-2	0.12-0.18	3.0-5.9	0.5-1.0	.32	.32			
	24-28	25-65	10-40	18-35	1.40-1.55	0.6-2	0.12-0.18	2.5-5.9	0.1-0.5	.32	.32			
	28-50	25-70	10-40	18-35	1.40-1.60	0.6-2	0.12-0.18	1.5-4.0	0.1-0.5	.32	.32			
	50-80	25-70	10-40	18-35	1.40-1.60	0.6-2	0.12-0.18	1.5-4.0	0.1-0.5	.32	.32			
TuA:														
Tucumcari-----------	0-5	20-45	20-45	27-40	1.30-1.40	0.6-2	0.12-0.20	3.0-5.9	1.0-2.0	.32	.32	5	4L	86
	5-16	5-65	10-60	30-50	1.25-1.35	0.06-0.6	0.12-0.20	6.0-8.9	0.1-0.5	.28	.28			
	16-30	5-65	10-60	30-50	1.25-1.35	0.06-0.6	0.12-0.20	6.0-8.9	0.1-0.5	.28	.28			
	30-45	5-65	10-60	30-50	1.25-1.35	0.06-0.6	0.12-0.20	6.0-8.9	0.1-0.5	.28	.28			
	45-80	25-65	10-40	25-40	1.45-1.55	0.06-0.6	0.12-0.18	3.0-5.9	0.1-0.5	.32	.32			
W:														
Water---------------	---	---	---	---	---	---	---	---	---	---	---	-	---	---

Table 27.--Chemical Soil Properties

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
BcA:								
Bippus---------------	0-8	13-27	---	6.6-8.4	0-2	0	0.0-2.0	0
	8-14	12-26	---	7.4-8.4	0-2	0	0.0-2.0	0
	14-26	15-24	---	7.9-8.4	0-5	0	0.0-2.0	0
	26-49	15-24	---	7.9-8.4	0-5	0	0.0-2.0	0
	49-65	15-24	---	7.9-8.4	0-5	0	0.0-2.0	0
	65-80	7.4-21	---	7.9-8.4	3-15	0	0.0-2.0	0
BeD:								
Berda----------------	0-6	11-17	---	6.6-8.4	2-10	0	0.0-2.0	0
	6-20	12-23	---	7.4-8.4	2-10	0	0.0-2.0	0
	20-36	12-23	---	7.9-8.4	2-15	0	0.0-2.0	0
	36-52	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
	52-80	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
BfB:								
Berwolf--------------	0-11	2.9-11	---	6.6-8.4	0	0	0.0-2.0	0
	11-20	8.1-14	---	7.9-8.4	0-3	0	0.0-2.0	0
	20-34	8.1-12	---	7.9-8.4	0-5	0	0.0-2.0	0
	34-45	5.1-8.6	---	7.9-8.4	15-60	0	0.0-2.0	0
	45-80	3.6-5.5	---	7.9-8.4	15-50	0	0.0-2.0	0
BP:								
Borrow pits----------	0-20	---	---	7.9-8.4	20-80	0	0.0-2.0	0
	20-80	---	---	7.9-8.4	20-80	0	0.0-2.0	0
BpD:								
Berda----------------	0-6	11-17	---	6.6-8.4	2-10	0	0.0-2.0	0
	6-20	12-23	---	7.4-8.4	2-10	0	0.0-2.0	0
	20-36	12-23	---	7.9-8.4	2-15	0	0.0-2.0	0
	36-52	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
	52-80	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
Potter---------------	0-2	16-34	---	7.4-8.4	5-45	0	0.0-2.0	0
	2-6	11-32	---	7.9-8.4	5-45	0	0.0-2.0	0
	6-15	6.3-23	---	7.9-8.4	40-80	0	0.0-2.0	0
	15-29	5.2-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	29-55	5.5-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	55-80	5.1-18	---	7.9-9.0	20-80	0	0.0-2.0	0
BVD:								
Berda----------------	0-6	11-17	---	6.6-8.4	2-10	0	0.0-2.0	0
	6-20	12-23	---	7.4-8.4	2-10	0	0.0-2.0	0
	20-36	12-23	---	7.9-8.4	2-15	0	0.0-2.0	0
	36-52	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
	52-80	12-22	---	7.9-8.4	5-15	0	0.0-2.0	0
Veal-----------------	0-8	6.2-10	---	6.6-8.4	5-30	0	0.0-2.0	0
	8-17	6.3-13	---	7.9-9.0	15-60	0	0.0-2.0	0
	17-36	4.5-11	---	7.9-9.0	15-60	0	0.0-2.0	0
	36-80	4.5-11	---	7.9-9.0	15-60	0	0.0-2.0	0

Table 27.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
DRC:								
Drake----------------	0-5	7.1-17	---	7.4-8.4	2-15	0-2	0.0-4.0	0-13
	5-15	7.1-20	---	7.4-8.4	2-15	0-2	0.0-4.0	0-13
	15-28	10-20	---	7.9-9.0	10-30	0-4	0.0-4.0	0-13
	28-43	10-20	---	7.9-9.0	10-30	0-4	0.0-4.0	0-13
	43-69	10-20	---	7.9-9.0	10-30	0-4	0.0-4.0	0-13
	69-80	10-20	---	7.9-9.0	10-30	0-4	0.0-4.0	0-13
EcA:								
Estacado-------------	0-6	22-32	---	7.4-8.4	0-2	0	0.0-2.0	0
	6-19	16-31	---	7.4-8.4	0-5	0	0.0-2.0	0
	19-38	15-30	---	7.4-8.4	0-10	0	0.0-2.0	0
	38-50	9.7-30	---	7.9-8.4	15-60	0	0.0-2.0	0
	50-80	7.5-30	---	7.9-8.4	5-60	0	0.0-2.0	0
FrB:								
Friona---------------	0-8	13-22	---	6.6-8.4	0	0	0	0
	8-15	16-27	---	7.4-8.4	0-10	0	0	0
	15-26	15-27	---	7.4-8.4	0-10	0	0	0
	26-31	14-23	---	7.4-8.4	0-10	0	0	0
	31-35	---	---	---	---	---	---	---
	35-80	12-18	---	7.9-8.4	15-40	0	0	0
GQE:								
Glenrio--------------	0-4	25-41	---	7.9-8.4	5-10	0	0.0-2.0	0-2
	4-14	25-41	---	7.9-8.4	5-10	0	0.0-2.0	0-2
	14-60	---	---	---	---	---	---	---
Quay-----------------	0-3	6.3-20	---	7.9-8.4	1-3	0	0.0-2.0	0-2
	3-9	5.9-18	---	7.9-8.4	1-3	0	0.0-2.0	0-2
	9-19	13-21	---	7.9-8.4	1-10	0	0.0-2.0	0-2
	19-26	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
	26-36	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
	36-80	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
IMC:								
Ima------------------	0-5	4.6-17	---	7.4-8.4	0-5	0	0.0-1.0	0-1
	5-10	4.3-16	---	7.4-8.4	0-5	0	0.0-2.0	0-1
	10-32	4.3-16	---	7.9-8.4	1-15	0	0.0-2.0	0-1
	32-40	4.3-16	---	7.9-8.4	1-15	0	0.0-2.0	0-1
	40-80	4.3-16	---	7.9-8.4	1-15	0	0.0-1.0	0-1
Lacoca---------------	0-8	4.3-17	---	7.9-8.4	0-5	0	0.0-2.0	0
	8-80	---	---	---	---	---	---	---
KmB:								
Kimberson------------	0-5	10-17	---	7.4-8.4	0-20	0	0.0-1.0	0
	5-11	5.6-15	---	7.9-8.4	0-30	0	0.0-1.0	0
	11-28	---	---	7.9-8.4	60-90	0	0	0
	28-64	3.1-5.1	---	7.9-8.4	40-80	0	0.0-1.0	0
	64-80	---	---	7.9-9.0	60-90	0	0	0
LcA:								
Lazbuddie------------	0-4	36-38	---	7.4-8.4	5-25	0	0.0-2.0	0-1
	4-12	36-37	---	7.4-8.4	5-26	0	0.0-2.0	0-2
	12-35	35-39	---	7.4-8.4	10-25	0	0.0-2.0	0-2
	35-45	34-37	---	7.4-8.4	15-40	0-2	0.0-2.0	0-2
	45-69	34-36	---	7.4-8.4	20-40	0-2	0.0-2.0	0-2
	69-80	30-36	---	7.4-8.4	5-30	0-2	0.0-2.0	0-2

Table 27.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
LoA:								
Lofton	0-9	24-32	---	6.6-8.4	0	0	0	0
	9-24	30-34	---	7.4-8.4	0-5	0	0	0
	24-38	30-34	---	7.4-8.4	0-5	0	0	0
	38-52	21-31	---	7.9-8.4	5-30	0	0	0
	52-80	19-27	---	7.9-8.4	5-40	0	0	0
M-W:								
Water, miscellaneous	---	---	---	---	---	---	---	---
McA:								
McLean	0-7	36-47	---	6.1-8.4	0-2	0	0	0
	7-21	36-46	---	6.6-8.4	0-2	0	0.0-2.0	0
	21-37	36-46	---	6.6-8.4	0-2	0	0.0-2.0	0-1
	37-42	36-46	---	6.6-8.4	0-2	0	0.0-2.0	0-2
	42-59	36-43	---	6.6-8.4	0-2	0	0.0-2.0	0-2
	59-80	34-39	---	7.9-8.4	1-12	0	0.0-2.0	0-2
MNA:								
Minneosa	0-10	4.0-7.7	---	7.4-8.4	0	0	0	0-1
	10-44	3.1-7.6	---	7.4-7.8	5-10	0	0	0-1
	44-80	1.4-4.2	---	7.4-7.8	5-10	0	0.0-2.0	0-1
MoC:								
Mobeetie	0-8	8.6-12	---	7.9-8.4	1-10	0	0	0
	8-25	6.6-10	---	7.9-8.4	2-10	0	0	0
	25-41	6.6-10	---	7.9-8.4	4-15	0	0	0
	41-80	6.6-10	---	7.9-8.4	4-15	0	0	0
MoD:								
Mobeetie	0-7	8.6-12	---	7.9-8.4	1-10	0	0	0
	7-23	6.6-10	---	7.9-8.4	2-10	0	0	0
	23-39	6.6-10	---	7.9-8.4	4-15	0	0	0
	39-80	6.6-10	---	7.9-8.4	4-15	0	0	0
MVE:								
Mobeetie	0-8	8.6-12	---	7.9-8.4	1-10	0	0	0
	8-25	6.6-10	---	7.9-8.4	2-10	0	0	0
	25-41	6.6-10	---	7.9-8.4	4-15	0	0	0
	41-80	6.6-10	---	7.9-8.4	4-15	0	0	0
Veal	0-8	6.2-10	---	6.6-8.4	5-30	0	0.0-2.0	0
	8-17	6.3-13	---	7.9-9.0	15-60	0	0.0-2.0	0
	17-36	4.5-11	---	7.9-9.0	15-60	0	0.0-2.0	0
	36-80	4.5-11	---	7.9-9.0	15-60	0	0.0-2.0	0
Potter	0-2	16-34	---	7.4-8.4	5-45	0	0.0-2.0	0
	2-6	11-32	---	7.9-8.4	5-45	0	0.0-2.0	0
	6-15	6.3-23	---	7.9-8.4	40-80	0	0.0-2.0	0
	15-29	5.2-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	29-55	5.5-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	55-80	5.1-18	---	7.9-9.0	20-80	0	0.0-2.0	0

Table 27.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
OcA:								
Olton----------------	0-8	18-28	---	6.6-8.4	0	0	0.0-1.0	0
	8-15	22-34	---	7.4-8.4	0-5	0	0.0-1.0	0-1
	15-31	23-38	---	7.4-8.4	0-5	0	0.0-1.0	0-1
	31-48	20-31	---	7.9-8.4	5-60	0	0.0-1.0	0-1
	48-75	12-30	---	7.9-8.4	5-60	0	0.0-1.0	0-1
	75-80	11-30	---	7.9-8.4	5-60	0	0.0-1.0	0-1
OcB:								
Olton----------------	0-7	18-28	---	6.6-8.4	0	0	0.0-1.0	0
	7-13	22-34	---	7.4-8.4	0-5	0	0.0-1.0	0-1
	13-29	23-38	---	7.4-8.4	0-5	0	0.0-1.0	0-1
	29-46	20-31	---	7.9-8.4	5-60	0	0.0-1.0	0-1
	46-73	12-30	---	7.9-8.4	5-60	0	0.0-1.0	0-1
	73-80	11-30	---	7.9-8.4	5-60	0	0.0-1.0	0-1
PcA:								
Pep------------------	0-10	21-28	---	7.4-8.4	2-5	0	0.0-2.0	0
	10-16	14-21	---	7.4-8.4	5-15	0	0.0-2.0	0
	16-32	13-20	---	7.4-8.4	5-50	0	0.0-2.0	0
	32-80	10-15	---	7.8-8.4	15-60	0	0.0-2.0	0
PcB:								
Pep------------------	0-9	21-28	---	7.4-8.4	2-5	0	0.0-2.0	0
	9-15	14-21	---	7.4-8.4	5-15	0	0.0-2.0	0
	15-31	13-20	---	7.4-8.4	5-50	0	0.0-2.0	0
	31-80	10-15	---	7.8-8.4	15-60	0	0.0-2.0	0
PcC:								
Pep------------------	0-8	21-28	---	7.4-8.4	2-5	0	0.0-2.0	0
	8-14	14-21	---	7.4-8.4	5-15	0	0.0-2.0	0
	14-30	13-20	---	7.4-8.4	5-50	0	0.0-2.0	0
	30-80	10-15	---	7.8-8.4	15-60	0	0.0-2.0	0
PGE:								
Potter---------------	0-2	16-34	---	7.4-8.4	5-45	0	0.0-2.0	0
	2-6	11-32	---	7.9-8.4	5-45	0	0.0-2.0	0
	6-15	6.3-23	---	7.9-8.4	40-80	0	0.0-2.0	0
	15-29	5.2-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	29-55	5.5-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	55-80	5.1-18	---	7.9-9.0	20-80	0	0.0-2.0	0
PMG:								
Potter---------------	0-2	16-34	---	7.4-8.4	5-45	0	0.0-2.0	0
	2-6	11-32	---	7.9-8.4	5-45	0	0.0-2.0	0
	6-15	6.3-23	---	7.9-8.4	40-80	0	0.0-2.0	0
	15-29	5.2-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	29-55	5.5-18	---	7.9-9.0	20-80	0	0.0-2.0	0
	55-80	5.1-18	---	7.9-9.0	20-80	0	0.0-2.0	0
Mobeetie-------------	0-8	8.6-12	---	7.9-8.4	1-10	0	0	0
	8-25	6.6-10	---	7.9-8.4	2-10	0	0	0
	25-41	6.6-10	---	7.9-8.4	4-15	0	0	0
	41-80	6.6-10	---	7.9-8.4	4-15	0	0	0

Table 27.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
PnC:								
Plemons	0-6	4.8-19	---	7.9-8.4	0-15	0	0.0-2.0	0-1
	6-13	15-20	---	7.9-9.0	5-40	0	0.0-2.0	0-2
	13-35	14-23	---	7.9-9.0	5-40	0	0.0-2.0	0-2
	35-58	16-27	---	7.9-9.0	5-40	0	0.0-2.0	0-2
	58-76	16-28	---	7.9-9.0	5-40	0	0.0-2.0	0-4
	76-80	21-37	---	7.9-8.4	0-15	0	0.0-2.0	0-4
PrA:								
Portales	0-15	21-29	---	7.9-8.4	1-5	0	0.0-2.0	0
	15-35	15-28	---	7.4-8.4	2-15	0	0.0-1.0	0
	35-43	5.4-26	---	7.4-8.4	15-60	0	0.0-1.0	0
	43-60	7.0-26	---	7.4-8.4	15-60	0	0.0-1.0	0
	60-80	14-26	---	7.4-8.4	15-60	0	0.0-1.0	0
PuA:								
Pullman	0-5	22-32	---	6.6-8.4	0	0	0.0-2.0	0
	5-18	30-42	---	7.4-8.4	0	0	0.0-2.0	0
	18-33	28-37	---	7.4-8.4	0-2	0-2	0.0-2.0	0
	33-52	25-37	---	7.9-8.4	0-15	0-2	0.0-2.0	0
	52-66	20-37	---	7.9-8.4	20-60	0-2	0.0-2.0	0
	66-80	15-37	---	7.9-8.4	20-60	0-2	0.0-2.0	0
PuB:								
Pullman	0-4	22-32	---	6.6-8.4	0	0	0.0-2.0	0
	4-17	30-42	---	7.4-8.4	0	0	0.0-2.0	0
	17-32	28-37	---	7.4-8.4	0-2	0-2	0.0-2.0	0
	32-51	25-37	---	7.9-8.4	0-15	0-2	0.0-2.0	0
	51-65	20-37	---	7.9-8.4	20-60	0-2	0.0-2.0	0
	65-80	15-37	---	7.9-8.4	20-60	0-2	0.0-2.0	0
PxA:								
Pantex	0-7	22-32	---	6.6-7.8	0-2	0	0.0-2.0	0
	7-20	27-42	---	7.4-8.4	0-3	0	0.0-2.0	0-2
	20-34	27-42	---	7.4-8.4	0-5	0	0.0-2.0	0-4
	34-49	25-40	---	7.4-8.4	0-5	0	0.0-2.0	0-4
	49-71	24-40	---	7.4-8.4	0-5	0	0.0-2.0	0-4
	71-80	13-34	---	7.9-8.4	15-60	0	0.0-2.0	0-4
QcB:								
Quay	0-3	6.3-19	---	7.9-8.4	1-3	0	0.0-2.0	0-2
	3-9	5.9-18	---	7.9-8.4	1-3	0	0.0-2.0	0-2
	9-19	13-21	---	7.9-8.4	1-10	0	0.0-2.0	0-2
	19-26	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
	26-36	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
	36-80	12-27	---	7.9-8.4	15-40	0	0.0-2.0	0-2
RaA:								
Randall	0-3	37-50	---	6.1-7.8	0	0	0.0-2.0	0
	3-9	36-49	---	6.6-8.4	0	0	0.0-2.0	0
	9-17	36-49	---	6.6-8.4	0	0	0.0-2.0	0
	17-38	34-49	---	6.6-8.4	0	0	0.0-2.0	0
	38-62	34-48	---	6.6-8.4	0	0	0.0-2.0	0
	62-80	34-48	---	7.9-8.4	0-15	0	0.0-2.0	0

Table 27.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Effective cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	Inches	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
RfC:								
Redona	0-10	8.9-17	---	7.4-7.8	0	0	0.0-1.0	0-1
	10-24	14-22	---	7.4-7.8	0-10	0-1	0.0-2.0	0-5
	24-28	13-22	---	7.4-7.8	0-10	0-1	0.0-2.0	0-5
	28-50	12-20	---	7.4-9.0	15-35	0-1	0.0-2.0	0-5
	50-80	12-20	---	7.4-9.0	15-35	0-1	0.0-2.0	0-5
TuA:								
Tucumcari	0-5	21-31	---	7.9-8.4	0-3	0	0	0-4
	5-16	22-36	---	7.9-8.4	5-15	0	0	0-4
	16-30	22-36	---	7.9-8.4	5-15	0	0	0-4
	30-45	22-36	---	7.9-8.4	5-15	0	0	0-4
	45-80	19-29	---	7.9-8.4	5-15	0	0	0-4
W:								
Water	---	---	---	---	---	---	---	---

Table 28.--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	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
BcA:										
Bippus----------------------	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
BeD:										
Berda-----------------------	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
BfB:										
Berwolf---------------------	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 28.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
BP:										
Borrow pits	D	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	0.0-0.5	Long	Occasional	---	None
			May	---	---	0.0-2.0	Long	Occasional	---	None
			June	---	---	0.0-2.0	Long	Occasional	---	None
			July	---	---	0.0-2.0	Long	Occasional	---	None
			August	---	---	0.0-2.0	Long	Occasional	---	None
			September	---	---	0.0-2.0	Long	Occasional	---	None
			October	---	---	0.0-0.5	Long	Occasional	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
BpD:										
Berda	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
Potter	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 28.--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				
BVD:										
Berda	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
Veal	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
DRC:										
Drake	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

Table 28.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
EcA:										
Estacado	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
FrB:										
Friona	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
GQE:										
Glenrio	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 28.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
Quay	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
IMC:										
Ima	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
Lacoca	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 28.--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				
KmB:										
Kimberson	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
LcA:										
Lazbuddie	D	High								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	0.0-1.0	---	Rare	---	None
			June	---	---	0.0-1.0	---	Rare	---	None
			July	---	---	0.0-1.0	---	Rare	---	None
			August	---	---	0.0-1.0	---	Rare	---	None
			September	---	---	0.0-1.0	---	Rare	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
LoA:										
Lofton	D	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	---	---	None	---	None
			May	---	---	0.0-1.0	---	Rare	---	None
			June	---	---	0.0-1.0	---	Rare	---	None
			July	---	---	0.0-1.0	---	Rare	---	None
			August	---	---	0.0-1.0	---	Rare	---	None
			September	---	---	0.0-1.0	---	Rare	---	None
			October	---	---	---	---	None	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None

Table 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
M-W:										
Water, miscellaneous	---	---								
			January	---	---	6.1-6.1	Very long	Frequent	---	---
			February	---	---	6.1-6.1	Very long	Frequent	---	---
			March	---	---	6.1-6.1	Very long	Frequent	---	---
			April	---	---	6.1-6.1	Very long	Frequent	---	---
			May	---	---	6.1-6.1	Very long	Frequent	---	---
			June	---	---	6.1-6.1	Very long	Frequent	---	---
			July	---	---	6.1-6.1	Very long	Frequent	---	---
			August	---	---	6.1-6.1	Very long	Frequent	---	---
			September	---	---	6.1-6.1	Very long	Frequent	---	---
			October	---	---	6.1-6.1	Very long	Frequent	---	---
			November	---	---	6.1-6.1	Very long	Frequent	---	---
			December	---	---	6.1-6.1	Very long	Frequent	---	---
McA:										
McLean	D	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	---	---	0.0-0.6	Very brief	Occasional	---	None
			May	---	---	0.0-1.0	Brief	Occasional	---	None
			June	---	---	0.0-1.0	Brief	Occasional	---	None
			July	---	---	0.0-1.0	Brief	Occasional	---	None
			August	---	---	0.0-1.0	Brief	Occasional	---	None
			September	---	---	0.0-1.0	Brief	Occasional	---	None
			October	---	---	0.0-0.6	Very brief	Occasional	---	None
			November	---	---	---	---	None	---	None
			December	---	---	---	---	None	---	None
MNA:										
Minneosa	B	Negligible								
			April	---	---	---	---	None	Brief	Occasional
			May	---	---	---	---	None	Brief	Occasional
			June	---	---	---	---	None	Brief	Occasional
			July	---	---	---	---	None	Brief	Occasional
			August	---	---	---	---	None	Brief	Occasional
			September	---	---	---	---	None	Brief	Occasional
			October	---	---	---	---	None	Brief	Occasional

Table 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
MoC:										
Mobeetie	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
MoD:										
Mobeetie	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
MVE:										
Mobeetie	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 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
Veal	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
Potter	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
OcA:										
Olton	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 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
OcB:										
Olton	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
PcA:										
Pep	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
PcB:										
Pep	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 28.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
PcC:										
Pep	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
PGE:										
Potter	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
PMG:										
Potter	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 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
Mobeetie	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
PnC:										
Plemons	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
PrA:										
Portales	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

Table 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
PuA:										
Pullman	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
PuB:										
Pullman	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
PxA:										
Pantex	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 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
QcB:										
Quay	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
RaA:										
Randall	D	Negligible								
			January	---	---	---	---	None	---	None
			February	---	---	---	---	None	---	None
			March	---	---	---	---	None	---	None
			April	1.0-1.5	2.0-3.0	0.0-1.0	Brief	Frequent	---	None
			May	0.0-0.5	2.0-3.0	0.0-3.0	Long	Frequent	---	None
			June	0.0-0.5	2.0-3.0	0.0-3.0	Long	Frequent	---	None
			July	---	---	0.0-3.0	Long	Frequent	---	None
			August	---	---	0.0-3.0	Long	Frequent	---	None
			September	0.0-0.5	2.0-3.0	0.0-3.0	Long	Frequent	---	None
			October	0.0-0.5	2.0-3.0	0.0-1.0	Brief	Frequent	---	None
			November	1.0-1.5	2.0-3.0	---	---	None	---	None
			December	---	---	---	---	None	---	None
RfC:										
Redona	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 28.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Surface runoff	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
				Ft	Ft	Ft				
TuA:										
Tucumcari	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
W:										
Water	---	---								
			January	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			February	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			March	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			April	0.0-1.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			May	0.0-1.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			June	0.0-1.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			July	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			August	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			September	0.0-1.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			October	0.0-1.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			November	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None
			December	1.0-6.0	>6.0	6.1-6.1	Very long	Frequent	---	None

Table 29.--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				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
BcA:									
Bippus	---	---	---	---	0	---	None	Moderate	Low
BeD:									
Berda	---	---	---	---	0	---	None	Moderate	Low
BfB:									
Berwolf	---	---	---	---	0	---	Low	High	Low
BP:									
Borrow pits	---	---	---	---	0	---	None	High	Low
BpD:									
Berda	---	---	---	---	0	---	None	Moderate	Low
Potter	---	---	---	---	0	---	None	Moderate	Low
BVD:									
Berda	---	---	---	---	0	---	None	Moderate	Low
Veal	---	---	---	---	0	---	None	Moderate	Low
DRC:									
Drake	---	---	---	---	0	---	None	High	Low
EcA:									
Estacado	---	---	---	---	0	---	None	Moderate	Low
FrB:									
Friona	Petrocalcic	20-35	2-24	Indurated	0	---	None	Moderate	Low
GQE:									
Glenrio	Paralithic bedrock	10-20	60-70	Weakly cemented	0	---	None	High	Low
Quay	---	---	---	---	0	---	None	High	Low

Table 29.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
IMC:									
Ima	---	---	---	---	0	---	None	High	Low
Lacoca	Lithic bedrock	4-14	66-76	Indurated	0	---	None	Moderate	Low
KmB:									
Kimberson	Petrocalcic	4-20	5-50	Indurated	---	---	None	Moderate	Low
LcA:									
Lazbuddie	---	---	---	---	0	---	None	High	Low
LoA:									
Lofton	---	---	---	---	---	---	None	High	Low
M-W:									
Water, miscellaneous	---	---	---	---	---	---	---	---	---
McA:									
McLean	---	---	---	---	0	---	None	High	Low
MNA:									
Minneosa	---	---	---	---	---	---	None	High	Low
MoC:									
Mobeetie	---	---	---	---	---	---	None	Low	Low
MoD:									
Mobeetie	---	---	---	---	---	---	None	Low	Low
MVE:									
Mobeetie	---	---	---	---	---	---	None	Low	Low
Veal	---	---	---	---	0	---	None	Moderate	Low
Potter	---	---	---	---	0	---	None	Moderate	Low
OcA:									
Olton	---	---	---	---	0	---	None	Moderate	Low
OcB:									
Olton	---	---	---	---	0	---	None	Moderate	Low

Table 29.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
PcA:									
Pep	---	---	---	---	0	---	None	High	Low
PcB:									
Pep	---	---	---	---	0	---	None	High	Low
PcC:									
Pep	---	---	---	---	0	---	None	High	Low
PGE:									
Potter	---	---	---	---	0	---	None	Moderate	Low
PMG:									
Potter					0	---	None	Moderate	Low
Mobeetie	---	---	---	---	0	---	None	Low	Low
PnC:									
Plemons	---	---	---	---	0	---	None	Moderate	Low
PrA:									
Portales	---	---	---	---	0	---	None	High	Low
PuA:									
Pullman	---	---	---	---	0	---	None	High	Low
PuB:									
Pullman	---	---	---	---	0	---	None	High	Low
PxA:									
Pantex	---	---	---	---	0	---	None	High	Low
QcB:									
Quay	---	---	---	---	0	---	None	High	Low
RaA:									
Randall	---	---	---	---	0	---	None	High	Low
RfC:									
Redona	---	---	---	---	0	---	None	Moderate	Low

Table 29.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
TuA:									
Tucumcari	---	---	---	---	0	---	None	High	Low
W:									
Water	---	---	---	---	0	---	---	---	---

Table 30.--Physical Analyses of Selected Soils.

(Except where noted, location of the pedon sample is the same as that of the typical pedon described in the section "Soil Series and Their Morphology.")

Soil Name and Sample number	Depth	Horizon	Particle Size distribution (percent less than 2 mm): Sand, Very Coarse (2-1 mm)	Sand, Coarse (1-0.5 mm)	Sand, Medium (0.5-0.25 mm)	Sand, Fine (0.25-0.1 mm)	Sand, Very Fine (0.1-0.05 mm)	Sand, Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	COLE	Bulk Density 1/3 bar	Water Content 1/3 bar
	In.										Cm/cm	g/cc	Pct. (wt)
McLean[1]													
(S94TX065-001)	0 to 4	A1	0.3	0.4	0.3	0.8	5.0	6.8	33.4	59.8	0.158	1.14	43.2
	4 to 7	A2	0.5	0.9	0.4	0.8	4.9	7.5	34.5	58.0	0.154	1.13	43.1
	7 to 15	Bss1	0.6	0.5	0.7	0.8	4.9	7.5	34.3	58.2	0.155	1.16	43.1
	15 to 21	Bss2	0.8	0.7	0.4	0.9	5.1	7.9	34.4	57.7	0.157	1.16	44.3
	21 to 37	Bss3	0.6	0.7	0.4	0.8	5.0	7.5	32.8	59.7	0.157	1.14	45.3
	37 to 42	Bss4	0.7	1.0	0.5	0.6	4.7	7.5	34.0	58.5	0.152	1.15	43.9
	42 to 59	Bss5	0.5	0.6	0.4	0.7	4.8	7.0	34.2	58.8	0.159	1.14	45.1
	59 to 72	Bkss1	0.3	0.4	0.4	0.7	5.6	7.4	37.5	55.1	0.161	1.13	46.5
	72 to 80	Bkss2	0.4	0.3	0.3	0.8	8.0	9.8	36.6	53.6	0.131	1.25	39.5
Olton[1,2,4]													
(S06TX069-003)	0 to 5	Ap	---	0.1	2.2	11.2	16.8	30.3	37.9	31.8	0.062	1.27	25.0
	5 to 10	Bt1	---	0.1	2.1	11.5	16.8	30.5	36.8	32.7	0.072	1.39	25.6
	10 to 18	Bt2	---	---	1.9	11.4	13.8	27.1	33.9	39.0	0.076	1.39	26.9
	18 to 39	Btk	0.2	0.2	2.7	12.3	14.7	30.1	33.0	36.9	0.055	1.48	22.8
	39 to 49	Btkk1	0.1	0.2	2.0	7.9	10.4	20.6	38.1	41.3	0.016	1.43	22.8
	49 to 80	Btkk2	0.2	0.3	1.7	8.4	10.8	21.4	40.3	38.3	0.028	1.50	18.8
Pantex[1]													
(S93TX065-002)	0 to 7	Ap	tr	0.1	0.2	1.4	10.6	12.3	53.8	33.9	0.059	1.43	25.8
	7 to 20	Bt1	tr	tr	0.2	1.4	8.3	9.9	48.0	42.1	0.089	1.38	30.3
	20 to 34	Bt2	0.2	0.1	0.3	1.2	9.3	11.1	47.4	41.5	0.093	1.38	31.0
	34 to 49	Bt3	0.4	0.2	0.3	1.4	10.7	13.0	47.6	39.4	0.076	1.38	30.3
	49 to 60	Bt4	0.3	0.2	0.2	1.7	13.7	16.1	44.8	39.1	0.067	1.39	30.6
	60 to 71	Bt5	0.1	0.1	0.1	2.5	15.5	18.3	45.2	36.5	0.067	1.35	30.6
	71 to 80	Btk	tr	0.1	0.2	1.6	10.9	12.8	47.1	40.1		1.45	23.8

Table 30.--Physical Analyses of Selected Soils--Continued

			Particle Size distribution (percent less than 2 mm)										
			Sand						Silt	Clay			
Soil Name and Sample number	Depth	Horizon	Very Coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very Fine (0.1-0.05 mm)	Total (2-0.05 mm)	(0.05-0.002 mm)	(<0.002 mm)	COLE	Bulk Density 1/3 bar	Water Content 1/3 bar
	In.										Cm/cm	g/cc	Pct. (wt)
Plemons[1]													
(S97TX375-001)	0 to 6	A	0.5	0.4	0.7	7.1	24.8	33.5	45.1	21.4	---	---	---
	6 to 13	Btk1	0.9	0.6	0.8	4.8	18.1	25.2	43.1	31.7	---	---	---
	13 to 24	Btk2	0.5	0.6	0.8	4.7	14.3	20.9	48.3	30.8	0.033	1.36	21.0
	24 to 35	Btk3	0.9	0.5	0.5	6.2	21.1	29.2	42.8	28.0	0.038	1.48	21.0
	35 to 46	Btk4	0.7	0.4	0.6	6.7	21.7	30.1	38.0	31.9	0.039	1.47	22.1
	46 to 58	Btk5	0.6	0.8	0.7	3.0	14.9	20.0	43.1	36.9	0.049	1.46	24.3
	58 to 76	Btk6	0.6	0.4	0.3	3.8	16.5	21.6	43.4	35.0	0.041	1.38	26.6
	76 to 80	Btkb	tr	0.1	0.2	5.6	15.6	21.5	33.5	45.0	0.047	1.36	28.9
Portales[1,5]													
(S95TX305-002)	0 to 12	A	0.1	0.3	3.1	19.3	23.2	46	27.2	26.8	---	---	---
	12 to 18	Bw	tr	0.1	2.5	17.2	22.3	42.1	26.5	31.4	---	---	---
	18 to 24	Bk1	tr	0.1	1.7	13.9	21	36.7	28.7	34.6	---	---	---
	24 to 41	Bk2	0.1	0.2	2.3	14.7	22.3	39.6	26.2	34.2	---	---	---
	41 to 84	Bk3	0.1	0.4	2.7	15.4	16	34.6	25.6	39.8	---	---	---
Pullman[1,6]													
(S97TX153-001)	0 to 7	Ap	tr	0.1	1.1	10.4	14.3	25.9	45.9	28.2	0.026	1.34	25.8
	7 to 15	Bt1	tr	0.1	1.0	8.6	11.1	20.8	31.5	47.7	0.064	1.32	32.7
	15 to 22	Bt2	0.1	tr	1.0	8.4	10.6	20.1	33.0	46.9	0.079	1.33	33.1
	22 to 29	Bt3	tr	0.1	0.9	9.5	11.2	21.7	33.6	44.7	0.085	1.34	33.3
	29 to 42	Btk1	0.1	0.1	0.8	7.9	11.0	19.9	34.5	45.6	0.093	1.34	32.1
	42 to 48	Btk2	0.1	0.1	0.7	7.7	11.6	20.2	32.1	47.7	0.112	1.28	34.3
	48 to 59	Bk	0.1	0.3	1.3	8.6	9.2	19.5	35.2	45.3	0.033	1.28	26.0
	59 to 72	B'tk1	0.4	0.4	1.0	9.1	10.6	21.5	37.0	41.5	0.030	1.38	24.0
	72 to 80	B'tk2	0.7	0.4	1.0	9.2	10.4	21.7	38.0	40.3	0.039	1.32	26.4

Table 30.--Physical Analyses of Selected Soils--Continued

Soil Name and Sample number	Depth	Horizon	Particle Size distribution (percent less than 2 mm)								COLE	Bulk Density 1/3 bar	Water Content 1/3 bar
			Sand						Silt	Clay			
			Very Coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very Fine (0.1-0.05 mm)	Total (2-0.05 mm)	(0.05-0.002 mm)	(<0.002 mm)			
	In.										Cm/cm	g/cc	Pct. (wt)
Randall[1,3]													
(S97TX153-003)	0 to 3	A1	tr	0.1	0.2	1.8	5.2	7.3	36.1	56.6	0.108	1.22	35.9
	3 to 9	A2	tr	tr	0.3	2.3	5.1	7.7	29.4	62.9	0.114	1.20	36.8
	9 to 17	Bw	0.2	0.1	0.2	2.3	5.2	8.0	29.3	62.7	0.125	1.18	38.3
	17 to 38	Bss1	---	tr	0.3	2.6	5.4	8.3	30.1	61.6	0.128	1.20	38.7
	38 to 51	Bss2	---	tr	0.2	2.0	5.1	7.3	30.1	62.6	0.126	1.19	39.8
	51 to 62	Bss3	0.1	0.1	0.2	1.7	4.8	6.9	31.2	61.9	0.109	1.21	38.5
	62 to 80	Bkss	0.2	0.1	0.1	1.4	4.8	6.6	31.1	62.3	0.119	1.17	40.4

1 Analysis by National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.

2 This pedon is slightly outside the range of characteristics of the Olton series because a COLE of 6 is slightly above the range.

3 This pedon is outside the range of characteristics of the Randall series because the clay percentage is slightly above the range for fine.

4 Location of the pedon is in Castro County, Texas; from the intersection of Highway 168 and Highway 145 south of Hart, Texas; approximately 3.7 miles west on Highway 145, 2 miles south on county road, 530 feet southwest into cropland. Latitude: 34 degrees, 20 minutes, 54.5 seconds N; Longitude: 102 degrees, 10 minutes, 55.1 seconds W; Hart SW, Texas USGS quad; NAD 83.

5 Location of the pedon is in Lynn County, Texas; from the intersection of U.S. Highway 380 and U.S. Highway 87 in Tahoka, Texas; approximately 4.8 miles west on U.S. Highway 380, 2.7 miles south on county road, 1.6 miles east in rangeland. Latitude: 33 degrees, 07 minutes, 46.0 seconds N; Longitude: 101 degrees, 50 minutes, 55.0 seconds W; Tahoka, Texas USGS quad; NAD 83.

6 Location of the pedon is in Floyd County, Texas; from the intersection of U.S. Highway 62 and U.S. Highway 70 in Floydada, Texas; approximately 9 miles east on U.S. Highway 70, 3 miles south on county road, and 0.4 mile east in rangeland. Latitude: 33 degrees, 56 minutes, 10.7 seconds N; Longitude: 101 degrees, 10 minutes, 38.3 seconds W; Boothe, Texas USGS quad; NAD 83.

Table 31.--Chemical Analyses of Selected Soils

(Except where noted, location of the pedon sample is the same as that of the typical pedon described in the section “Soil Series and Their Morphology.”)

Soil Name and Sample number	Depth	Horizon	Extractable Bases					CEC	Electrical Conductivity	Base Saturation	Organic Carbon	pH (1:1 H2O)	CaCO3	SAR
			Ca	Mg	Na	K	Sum							
	In		Meq/100 g.						dSm-1	Pct.	Pct.		Pct.	
McLean[1]														
(S94TX065-001)	0 to 4	A1	---	3.8	0.2	2.5	---	37.4	0.53	100	0.94	7.9	1.0	tr
	4 to 7	A2	---	3.7	0.2	2.3	---	36.8	0.38	100	0.56	8.0	2.0	tr
	7 to 15	Bss1	---	3.3	0.3	1.8	---	35.8	---	100	0.49	7.8	2.0	---
	15 to 21	Bss2	---	3.4	0.3	1.6	---	36.0	---	100	0.41	8.0	4.0	---
	21 to 37	Bss3	---	3.1	0.4	1.5	---	36.6	---	100	0.38	8.0	2.0	---
	37 to 42	Bss4	---	3.5	0.4	1.4	---	36.3	---	100	0.35	8.0	3.0	---
	42 to 59	Bss5	---	3.4	0.4	1.3	---	36.3	---	100	0.33	8.1	2.0	---
	59 to 72	Bkss1	---	4.0	0.4	1.4	---	35.3	---	100	0.27	8.1	4.0	---
	72 to 80	Bkss2	---	4.1	0.5	1.3	---	31.5	---	100	0.20	8.1	5.0	---
Olton[1,2]														
(S06TX069-003)	0 to 5	Ap	13.0	6.3	---	1.9	21.2	19.6	0.52	100	1.18	7.1	---	---
	5 to 10	Bt1	14.6	5.9	---	1.1	21.6	20.4	---	100	0.65	7.6	---	---
	10 to 18	Bt2	18.6	7.0	0.1	0.9	26.6	23.7	---	100	0.63	7.8	---	---
	18 to 39	Btk	50.2	6.9	0.2	0.8	58.1	20.7	---	100	0.33	8.2	3.0	---
	39 to 49	Btkk1	45.6	3.7	0.3	0.4	50.0	7.2	---	100	0.45	8.5	54.0	---
	49 to 80	Btkk2	46.4	3.1	0.3	0.5	50.3	8.1	0.72	100	0.23	8.3	49.0	3.0
Pantex[1]														
(S93TX065-002)	0 to 7	Ap	15.8	4.9	0.2	1.9	22.8	23.9	---	95	1.36	7.5	---	---
	7 to 20	Bt1	---	6.2	1.0	1.0	---	28.8	0.47	100	0.62	8.1	1.0	2.0
	20 to 34	Bt2	---	5.8	1.7	0.8	---	26.4	0.61	100	0.37	8.4	4.0	4.0
	34 to 49	Bt3	---	5.1	1.6	1.0	---	26.1	0.90	100	0.26	8.2	2.0	4.0
	49 to 60	Bt4	---	4.6	1.7	0.9	---	25.2	1.19	100	0.21	8.1	1.0	3.0
	60 to 71	Bt5	27.1	4.3	1.6	0.7	33.7	25.1	1.53	100	0.18	8.0	tr	3.0
	71 to 80	Btk	---	2.8	1.1	0.4	---	13.6	1.91	100	0.11	8.0	43.0	3.0

Table 31.--Chemical Analyses of Selected Soils--Continued

Soil Name and Sample number	Depth	Horizon	Extractable Bases Ca	Mg	Na	K	Sum	CEC	Electrical Conductivity	Base Saturation	Organic Carbon	pH (1:1 H2O)	CaCO3	SAR
	In		Meq/100 g						dSm-1	Pct.	Pct.		Pct.	
Plemons[1]														
(S97TX375-001)	0 to 6	A	---	1.9	0.3	1.1	---	17.8	0.62	100	---	7.9	8.0	tr
	6 to 13	Btk1	---	2.1	0.3	0.7	---	16.3	0.52	100	---	8.2	20.0	tr
	13 to 24	Btk2	---	4.0	0.4	0.7	---	13.9	0.38	100	---	8.3	26.0	1.0
	24 to 35	Btk3	---	6.2	0.5	0.4	---	16.2	---	100	---	8.4	10.0	---
	35 to 46	Btk4	---	7.2	0.8	0.7	---	16.9	---	100	---	8.5	12.0	---
	46 to 58	Btk5	---	8.6	1.3	0.7	---	20.4	0.70	100	---	8.4	10.0	3.0
	58 to 76	Btk6	---	9.1	1.5	1.0	---	22.0	0.75	100	---	8.4	5.0	3.0
	76 to 80	Btkb	29.5	11.4	2.0	1.1	44.0	30.2	0.94	100	---	8.2	tr	3.0
Portales[1,3]														
(S95TX305-002)	0 to12	A	15.3	3.7	0.3	2.1	21.4	19.4	0.62	93	1.22	7.1	---	---
	12 to 18	Bw	---	4.5	0.3	0.8	---	18.0	0.73	100	0.7	7.6	3	---
	18 to 24	Bk1	---	5.1	---	1.4	---	14.8	0.36	100	0.4	7.8	14	---
	24 to 41	Bk2	---	5.8	---	1.3	---	9.6	0.22	100	0.35	7.9	16	---
	41 to 84	Bk3	---	9.1	---	0.5	---	10.4	0.39	100	0.24	7.9	25	---
Pullman[1,4]														
(S97TX153-001)	0 to 7	Ap	14.3	3.0	0.1	1.5	18.9	19.6	0.95	96	1.49	6.8	---	1.0
	7 to 15	Bt1	---	6.5	0.7	1.7	---	32.2	0.55	100	0.74	7.9	1.0	2.0
	15 to 22	Bt2	---	6.7	1.2	1.9	---	30.6	0.64	100	0.63	8.3	2.0	3.0
	22 to 29	Bt3	---	6.9	1.8	1.8	---	28.4	1.35	100	0.48	8.3	4.0	5.0
	29 to 42	Btk1	---	6.9	3.4	3.3	---	30.0	5.15	100	0.29	7.9	3.0	5.0
	42 to 48	Btk2	---	7.2	3.0	1.8	---	30.1	5.62	100	0.25	7.8	2.0	4.0
	48 to 59	Bk	---	3.0	1.3	0.5	---	11.0	5.12	100	0.17	7.8	51.0	3.0
	59 to 72	B'tk1	---	3.0	1.1	1.0	---	12.7	2.96	100	0.09	8.1	53.0	4.0
	72 to 80	B'tk2	---	3.1	0.9	1.2	---	12.8	2.82	100	0.09	8.1	52.0	4.0

Table 31.--Chemical Analyses of Selected Soils--Continued

Soil Name and Sample number	Depth	Horizon	Extractable Bases Ca	Mg	Na	K	Sum	CEC	Electrical Conductivity	Base Saturation	Organic Carbon	pH (1:1 H2O)	CaCO3	SAR
	In		Meq/100 g.						dSm-1	Pct.	Pct.		Pct.	
Randall[1]														
(S97TX153-003)	0 to 3	A1	18.3	7.3	0.3	3.2	29.1	34.5	1.14	84	1.81	6.1	---	tr
	3 to 9	A2	21.4	7.8	0.4	3.0	32.6	35.1	---	93	0.61	6.9	---	---
	9 to 17	Bw	17.5	6.1	0.1	2.4	26.1	35.2	---	74	0.56	6.8	---	---
	17 to 38	Bss1	20.6	7.2	0.1	2.5	30.4	34.6	---	88	0.50	6.9	---	---
	38 to 51	Bss2	23.2	7.1	0.2	2.0	32.5	34.9	---	93	0.41	6.9	---	---
	51 to 62	Bss3	31.1	7.7	0.4	2.6	41.8	35.4	---	100	0.25	8.0	tr	---
	62 to 80	Bkss	---	7.7	---	2.5	35.2	35.2	---	100	0.19	8.2	2.0	---

1 Analysis by National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.

2 Location of the pedon is in Castro County, Texas; from the intersection of Highway 168 and Highway 145 south of Hart, Texas; approximately 3.7 miles west on Highway 145, 2 miles south on county road, 530 feet southwest into cropland. Latitude: 34 degrees, 20 minutes, 54.5 seconds N; Longitude: 102 degrees, 10 minutes, 55.1 seconds W; Hart SW, Texas USGS quad; NAD 83.

3 Location of the pedon is in Lynn County, Texas; from the intersection of U.S. Highway 380 and U.S. Highway 87 in Tahoka, Texas; approximately 4.8 miles west on U.S. Highway 380, 2.7 miles south on county road, 1.6 miles east in rangeland. Latitude: 33 degrees, 07 minutes, 46.0 seconds N; Longitude: 101 degrees, 50 minutes, 55.0 seconds W; Tahoka, Texas USGS quad; NAD 83.

4 Location of the pedon is in Floyd County, Texas; from the intersection of U.S. Highway 62 and U.S. Highway 70 in Floydada, Texas; approximately 9 miles east on U.S. Highway 70, 3 miles south on county road, and 0.4 mile east in rangeland. Latitude: 33 degrees, 56 minutes, 10.7 seconds N; Longitude: 101 degrees, 10 minutes, 38.3 seconds W; Boothe, Texas USGS quad; NAD 83.

Table 32.--Clay Mineralogy of Selected Soils

Except where noted, location of the pedon sample is the same as that of the typical pedon described in the section “Soil Series and Their Morphology.”

Soil Name and Sample number	Depth	Horizon	Percentage of clay minerals[1] (x-ray diffraction)									
			Smectite	Mica	Kaolinite	Quartz	Calcite	Smectite-Mica[2]	Vermiculite	Hematite	Feldspar	Dolomite
	In											
McLean[3]												
(S94TX065-001)	0 to 4	A1	3	2	2	1	---	---	---	---	---	---
	15 to 21	Bss2	3	2	2	2	---	---	---	---	---	---
	37 to 42	Bss4	3	2	2	2	---	---	---	---	---	---
Olton[3,5]												
(S06TX069-003)	0 to 5	Ap	---	3	2	1	---	---	---	---	---	---
	10 to 18	Bt2	---	---	2	1	---	---	---	---	---	---
	49 to 80	Btkk2	---	1	1	---	3	---	---	---	---	---
Pantex[3]												
(S93TX065-002)	0 to 7	Ap	1	3	2	1	---	1	1	---	---	---
	34 to 49	Bt3	1	2	2	1	1	1	1	1	---	---
	60 to 71	Bt5	---	2	2	1	---	1	1	---	---	---
	71 to 80	Btk	1	2	2	---	4	1	1	---	---	---
Plemons[3]												
(S97TX375-001)	13 to 24	Btk2	2	2	2	1	4	2	---	---	---	---
Portales[3,6]												
(S95TX305-002)	24 to 41	Bk2	2	2	1	1	3	2	---	---	---	---
Pullman[3,4,7]												
(S97TX153-001)	7 to 15	Bt1	3	2	2	1	1	---	---	---	---	---
	15 to 22	Bt2	3	2	2	1	1	---	---	---	---	---
	22 to 29	Bt3	3	2	2	1	1	---	---	---	---	---
	29 to 42	Btk1	2	2	2	1	1	---	---	---	---	---
	42 to 48	Btk2	3	2	2	1	1	---	---	---	---	---
	59 to 72	B'tk1	2	1	1	---	---	---	---	---	---	---
	72 to 80	B'tk2	2	1	1	---	---	---	---	---	---	---

Table 32.--Clay Mineralogy of Selected Soils--Continued

Soil Name and Sample number	Depth	Horizon	Percentage of clay minerals[1] (x-ray diffraction) Smectite	Mica	Kaolinite	Quartz	Calcite	Smectite-Mica[2]	Vermiculite	Hematite	Feldspar	Dolomite
	In											
Randall[3]												
(S97TX153-003)	0 to 3	A1	2	3	2	1	---	---	---	---	---	---
	9 to 17	Bw	2	3	2	1	---	---	---	---	---	---
	17 to 38	Bss1	2	3	2	1	---	---	1	---	---	---
	38 to 51	Bss2	2	2	2	1	---	---	---	---	---	---

1 Clay minerals for soils are given as relative amounts, as follows: 1--trace; 2--small, 3--moderate; 4--abundant; 5—dominant.
2 Interstratified Smectite and Mica
3 Analysis by National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.
4 This pedon is outside the range of characteristics of the Pullman series because it has a higher percentage of smectite clays.
5 Location of the pedon is in Castro County, Texas; from the intersection of Highway 168 and Highway 145 south of Hart, Texas; approximately 3.7 miles west on Highway 145, 2 miles south on county road, 530 feet southwest into cropland. Latitude: 34 degrees, 20 minutes, 54.5 seconds N; Longitude: 102 degrees, 10 minutes, 55.1 seconds W; Hart SW, Texas USGS quad; NAD 83.
6 Location of the pedon is in Lynn County, Texas; from the intersection of U.S. Highway 380 and U.S. Highway 87 in Tahoka, Texas; approximately 4.8 miles west on U.S. Highway 380, 2.7 miles south on county road, 1.6 miles east in rangeland. Latitude: 33 degrees, 07 minutes, 46.0 seconds N; Longitude: 101 degrees, 50 minutes, 55.0 seconds W; Tahoka, Texas USGS quad; NAD 83.
7 Location of the pedon is in Floyd County, Texas; from the intersection of U.S. Highway 62 and U.S. Highway 70 in Floydada, Texas; approximately 9 miles east on U.S. Highway 70, 3 miles south on county road, and 0.4 mile east in rangeland. Latitude: 33 degrees, 56 minutes, 10.7 seconds N; Longitude: 101 degrees, 10 minutes, 38.3 seconds W; Boothe, Texas USGS quad; NAD 83.

Table 33.--Engineering Index Test Data

Except where noted, location of the pedon sample is the same as that of the typical pedon described in the section “Soil Series and Their Morphology.”

Soil Name, report number, horizon, and depth in inches	Horizon	AASHTO	Unified	Grain-size distribution: Percentage passing sieve -- No. 10	No. 40	No. 200	Percentage smaller than -- .05 mm	.005 mm	.002 mm	Liquid Limit	Plasticity Index
										Pct.	
McLean[1]											
(S94TX065-001)											
0 to 4	A1	---	---	100	99	96	93	68	60	---	---
4 to 7	A2	---	---	96	95	91	89	64	56	---	---
7 to 15	Bss1	---	---	100	99	95	93	67	58	---	---
15 to 21	Bss2	---	---	99	97	94	91	66	57	---	---
21 to 37	Bss3	---	---	100	99	95	93	68	60	---	---
37 to 42	Bss4	---	---	98	96	93	91	66	57	---	---
42 to 59	Bss5	---	---	99	98	95	92	67	58	---	---
59 to 72	Bkss1	---	---	100	99	96	93	65	55	---	---
72 to 80	Bkss2	---	---	100	99	95	90	62	54	---	---
Olton[1,2]											
(S06TX069-003)	Ap	---	---	100	99	80	70	37	32	---	---
	Bt1	---	---	100	99	80	70	38	33	---	---
	Bt2	---	---	100	100	81	73	44	39	---	---
	Btk	---	---	99	98	77	69	41	37	---	---
	Btkk1	---	---	96	95	82	76	49	40	---	---
	Btkk2	---	---	97	96	82	76	47	37	---	---
Pantex[1]											
(S93TX065-002)											
0 to 7	Ap	A-7-6	cl	100	100	94	88	43	34	41	23
7 to 20	Bt1	---	---	100	100	95	90	51	42	---	---
20 to 34	Bt2	---	---	91	91	86	81	46	38	---	---
34 to 49	Bt3	A-7-6	ch	100	99	93	87	48	39	50	33
49 to 60	Bt4	---	---	100	99	92	84	46	39	---	---
60 to 71	Bt5	A-7-6	cl	100	100	92	82	43	37	49	33
71 to 80	Btk	---	---	99	99	92	86	51	40	---	---

Table 33.--Engineering Index Test Data--Continued

Soil Name, report number, horizon, and depth in inches	Horizon	AASHTO	Unified	Grain-size distribution: Percentage passing sieve -- No. 10	No. 40	No. 200	Percentage smaller than -- .05 mm	.005 mm	.002 mm	Liquid Limit	Plasticity Index
Plemons[1]											
(S97TX375-001)											
0 to 6	A	---	---	99	98	82	66	26	21	---	---
6 to 13	Btk1	---	---	99	97	86	74	38	31	---	---
13 to 24	Btk2	---	---	99	98	86	78	40	30	---	---
24 to 35	Btk3	---	---	97	96	82	69	34	27	---	---
35 to 46	Btk4	---	---	97	96	81	68	38	31	---	---
46 to 58	Btk5	---	---	95	94	84	76	43	35	---	---
58 to 76	Btk6	---	---	99	98	88	78	43	35	---	---
76 to 80	Btkb	---	---	99	99	88	78	52	45	---	---
Portales[1,3]											
(S95TX305-002)											
0 to12	A	---	---	100	99	68	54	31	27	---	---
12 to 18	Bw	---	---	100	99	72	58	36	31	---	---
18 to 24	Bk1	---	---	100	99	76	63	40	35	---	---
24 to 41	Bk2	---	---	100	99	74	60	39	34	---	---
41 to 84	Bk3	---	---	100	99	75	65	45	40	---	---
Pullman[1,4]											
(S97TX153-001)											
0 to 7	Ap	---	---	98	98	81	73	36	28	---	---
7 to 15	Bt1	---	---	100	100	85	79	54	48	---	---
15 to 22	Bt2	---	---	100	100	86	80	53	47	---	---
22 to 29	Bt3	---	---	100	100	85	78	51	45	---	---
29 to 42	Btk1	---	---	100	100	86	80	53	46	---	---
42 to 48	Btk2	---	---	100	100	86	80	55	48	---	---
48 to 59	Bk	---	---	98	97	84	79	54	44	---	---
59 to 72	B'tk1	---	---	100	99	84	78	52	42	---	---
72 to 80	B'tk2	---	---	100	99	84	78	51	40	---	---

Table 33.--Engineering Index Test Data--Continued

Soil Name, report number, horizon, and depth in inches	Horizon	AASHTO	Unified	Grain-size distribution: Percentage passing sieve -- No. 10	No. 40	No. 200	Percentage smaller than -- .05 mm	.005 mm	.002 mm	Liquid Limit	Plasticity Index
										Pct.	
Randall[1]											
(S97TX153-003)											
0 to 3	A1	---	---	100	100	96	93	65	57	---	---
3 to 9	A2	---	---	100	100	95	92	70	63	---	---
9 to 17	Bw	---	---	100	100	95	92	71	63	---	---
17 to 38	Bss1	---	---	100	100	95	92	70	62	---	---
38 to 51	Bss2	---	---	100	100	96	93	70	63	---	---
51 to 62	Bss3	---	---	100	100	96	93	70	62	---	---
62 to 80	Bkss	---	---	100	100	96	93	70	62	---	---

1. Analysis by National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska.
2. Location of the pedon is in Castro County, Texas; from the intersection of Highway 168 and Highway 145 south of Hart, Texas; approximately 3.7 miles west on Highway 145, 2 miles south on county road, 530 feet southwest into cropland. Latitude: 34 degrees, 20 minutes, 54.5 seconds N; Longitude: 102 degrees, 10 minutes, 55.1 seconds W; Hart SW, Texas USGS quad; NAD 83.
3. Location of the pedon is in Lynn County, Texas; from the intersection of U.S. Highway 380 and U.S. Highway 87 in Tahoka, Texas; approximately 4.8 miles west on U.S. Highway 380, 2.7 miles south on county road, 1.6 miles east in rangeland. Latitude: 33 degrees, 07 minutes, 46.0 seconds N; Longitude: 101 degrees, 50 minutes, 55.0 seconds W; Tahoka, Texas USGS quad; NAD 83.
4. Location of the pedon is in Floyd County, Texas; from the intersection of U.S. Highway 62 and U.S. Highway 70 in Floydada, Texas; approximately 9 miles east on U.S. Highway 70, 3 miles south on county road, and 0.4 mile east in rangeland. Latitude: 33 degrees, 56 minutes, 10.7 seconds N; Longitude: 101 degrees, 10 minutes, 38.3 seconds W; Boothe, Texas USGS quad; NAD 83.

Table 34.--Taxonomic Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Berda	Fine-loamy, mixed, superactive, thermic Aridic Haplustepts
Berwolf	Coarse-loamy, mixed, superactive, thermic Ustic Calciargids
Bippus	Fine-loamy, mixed, superactive, thermic Cumulic Haplustolls
Drake	Fine-loamy, mixed, superactive, thermic Aridic Calciustepts
Estacado	Fine-loamy, mixed, superactive, thermic Aridic Paleustolls
Friona	Fine-loamy, mixed, superactive, thermic Petrocalcic Paleustolls
Glenrio	Clayey, mixed, superactive, thermic, shallow Ustic Haplocambids
Ima	Coarse-loamy, mixed, superactive, thermic Ustic Haplocambids
Kimberson	Loamy, mixed, superactive, thermic, shallow Petrocalcic Calciustolls
Lacoca	Loamy, mixed, superactive, calcareous, thermic Lithic Ustic Torriorthents
Lazbuddie	Fine, smectitic, thermic Calcic Haplusterts
Lofton	Fine, mixed, superactive, thermic Vertic Argiustolls
McLean	Fine, smectitic, thermic Udic Haplusterts
Minneosa	Sandy, mixed, thermic Ustic Torrifluvents
Mobeetie	Coarse-loamy, mixed, superactive, thermic Aridic Haplustepts
Olton	Fine, mixed, superactive, thermic Aridic Paleustolls
Pantex	Fine, mixed, superactive, thermic Torrertic Paleustolls
Pep	Fine-loamy, mixed, superactive, thermic Aridic Calciustolls
Plemons	Fine-loamy, mixed, superactive, thermic Calcidic Paleustalfs
Portales	Fine-loamy, mixed, superactive, thermic Aridic Calciustolls
Potter	Loamy-skeletal, carbonatic, thermic, shallow Petronodic Ustic Haplocalcids
Pullman	Fine, mixed, superactive, thermic Torrertic Paleustolls
Quay	Fine-silty, mixed, superactive, thermic Ustic Haplocalcids
Randall	Fine, smectitic, thermic Ustic Epiaquerts
Redona	Fine-loamy, mixed, superactive, thermic Ustic Calciargids
Tucumcari	Fine, smectitic, thermic Ustertic Haplargids
Veal	Fine-loamy, carbonatic, thermic Aridic Calciustepts

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