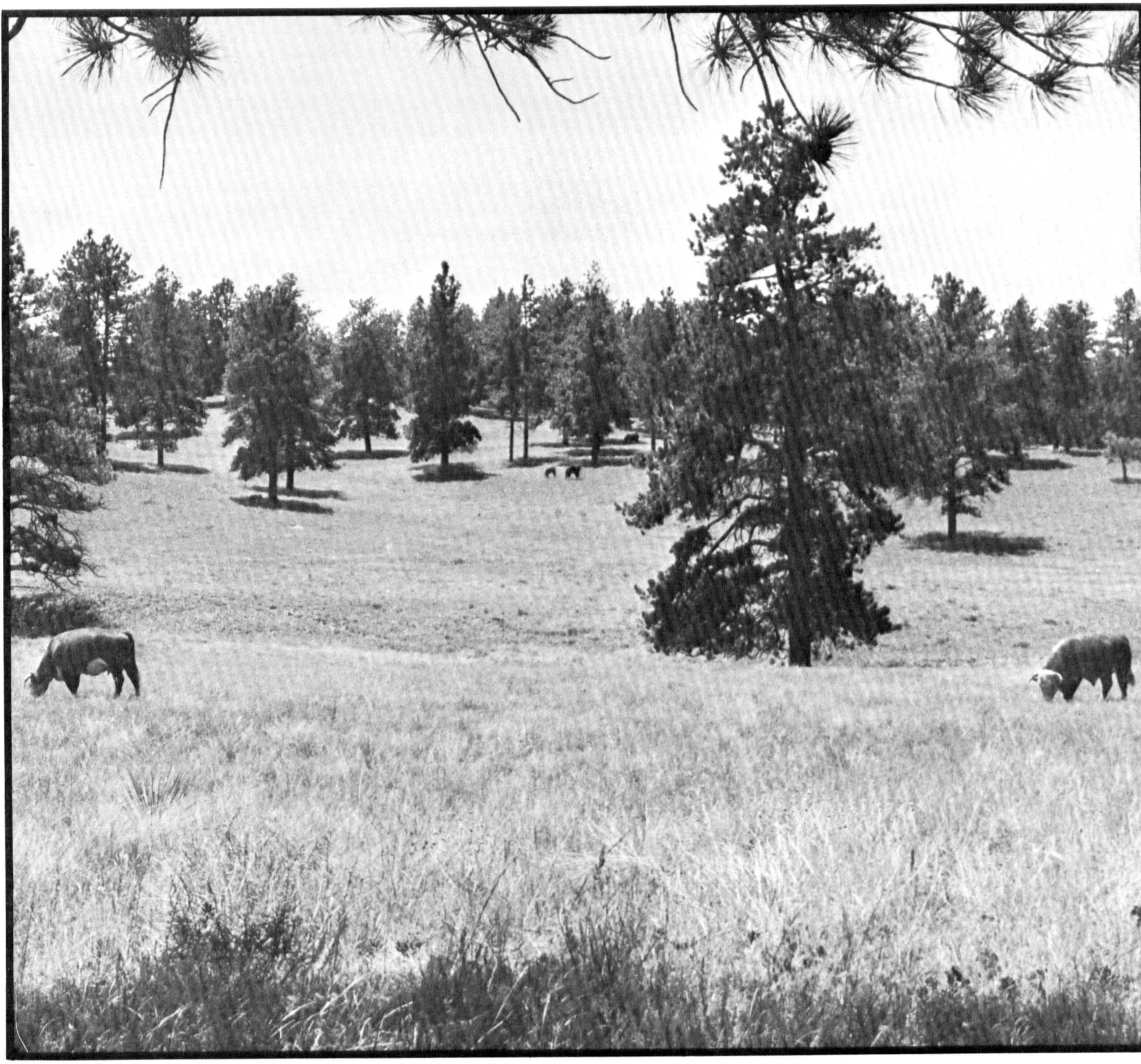


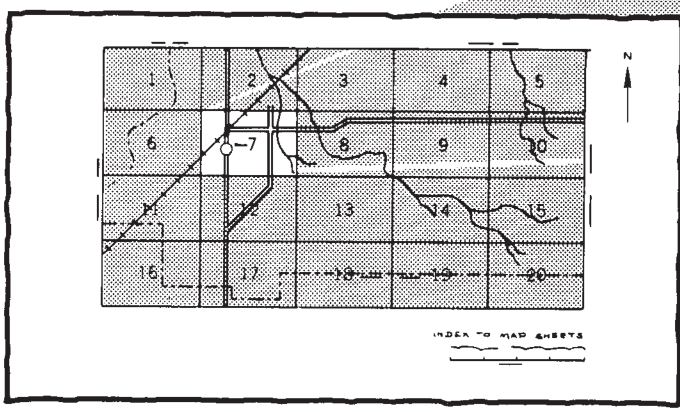
SOIL SURVEY OF

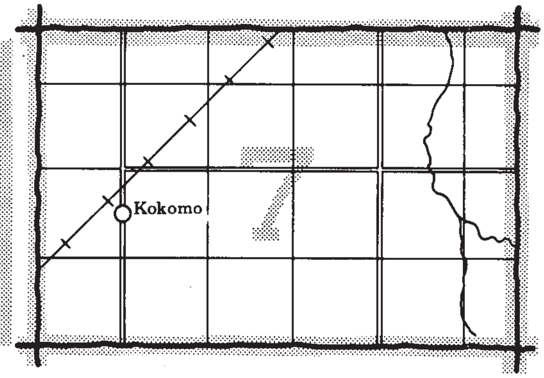
Elbert County, Colorado, Western Part

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

HOW TO USE

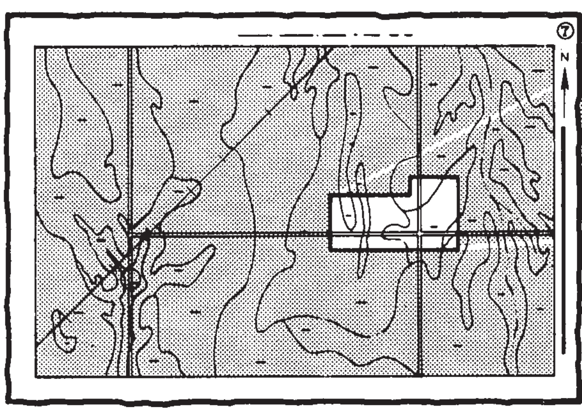
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

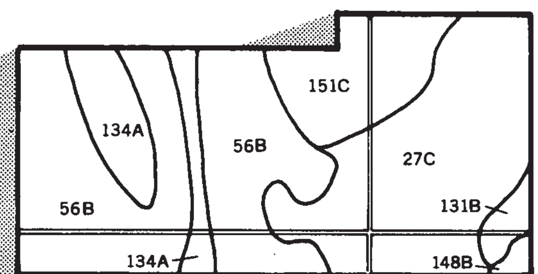




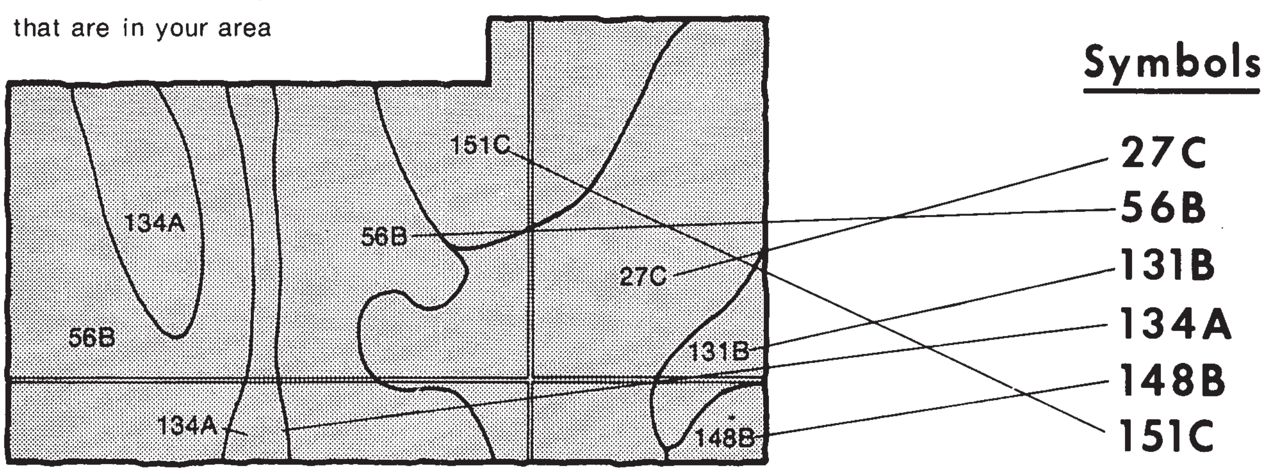
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



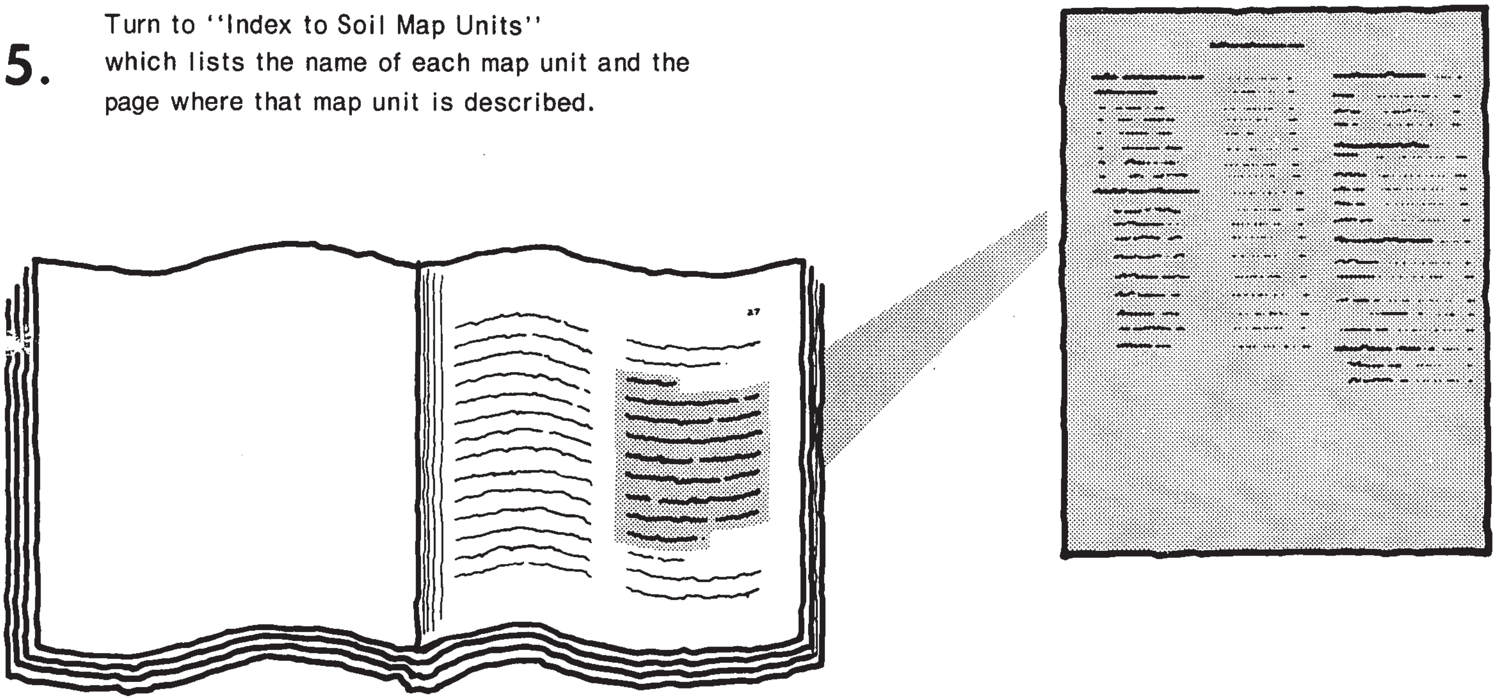


4. List the map unit symbols that are in your area

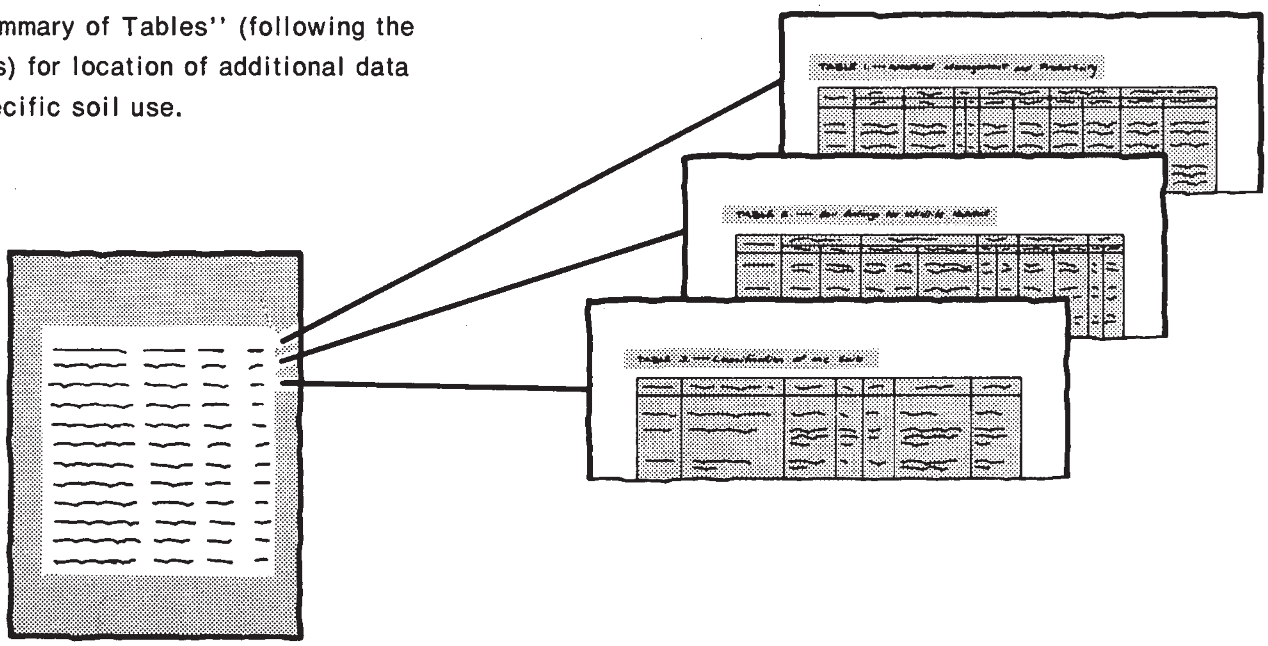


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1972-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Agate Soil Conservation District, the Double El Soil Conservation District, and the Kiowa Soil Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Landscape of Peyton-Elbeth sandy loams, 8 to 25 percent slopes.

Contents

Issued July 1980

Index to soil map units

Summary of tables

Summary of tables—Continued

Foreword

The Soil Survey of Elbert County, Colorado, Western Part, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

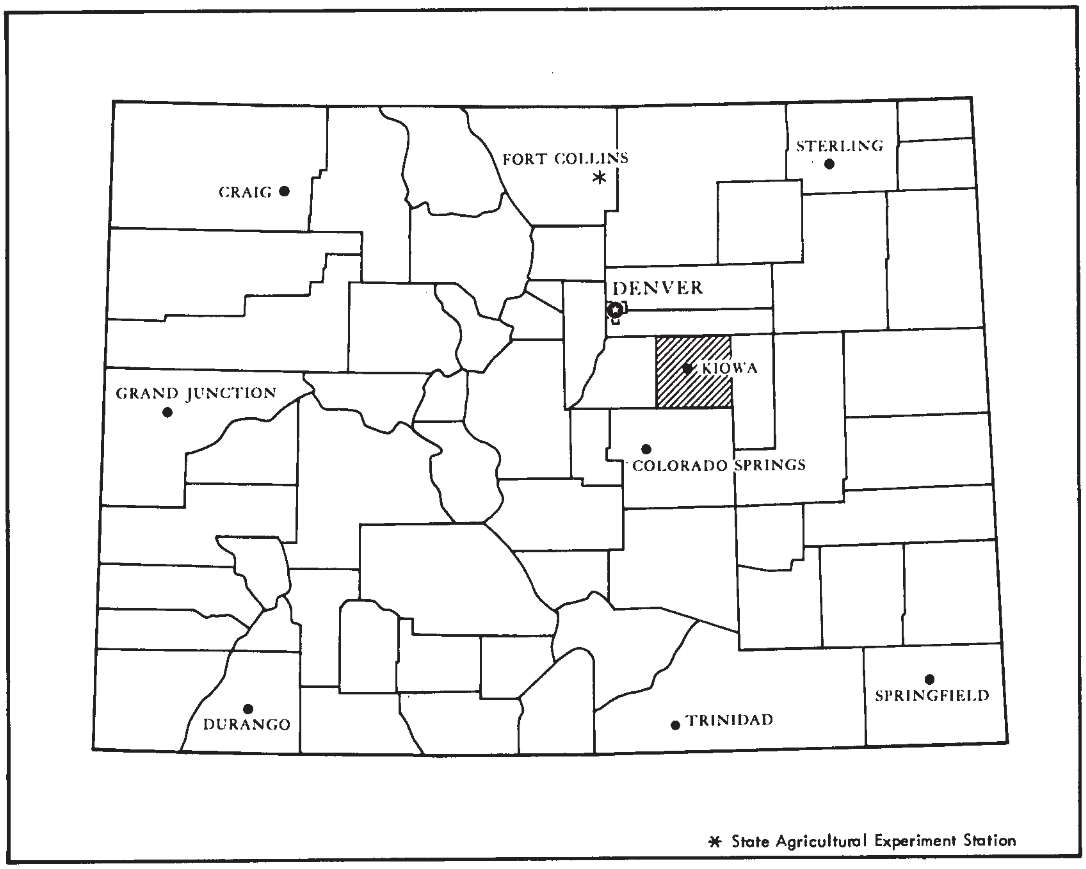
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Robert G. Halstead
State Conservationist
Soil Conservation Service



Location of Elbert County, Western Part, in Colorado.

SOIL SURVEY OF ELBERT COUNTY, COLORADO, WESTERN PART

By Lynn S. Larsen, Soil Conservation Service

Soils Surveyed by Lynn S. Larsen, Everett E. Geib, and Stanley R. Albee, Soil Conservation Service

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

ELBERT COUNTY is in the east-central part of Colorado. It has an area of 1,854 square miles, or 1,192,960 acres (see map on facing page). The population was 3,903 in 1970. Kiowa, the county seat, has a population of about 150. Only the western part of the county is discussed in this survey. A soil survey of the eastern part was published in July, 1966.

Elbert County, Western Part, has an area of 639,960 acres. It is located west of a line that originates at the northeastern corner of El Paso County and extends northward to Arapahoe County. The survey area includes the "Divide," which separates the Platte River and Arkansas River drainages.

Elevation ranges from 5,300 feet in the northeast corner to 7,300 feet in the southwest corner of the survey area. The high mesa area in the western part is separated by deep ravines which drain into Running Creek (Box Elder Creek), Kiowa Creek, and Commanche Creek. These creeks, along with West, Middle, and East Bijou Creeks, flow in a northeastern direction and are a part of the Platte River drainage. Big Sandy Creek in the southeast corner of the survey area flows in an eastern direction and is part of the Arkansas River drainage. The eastern part of the survey area is rolling plains.

Farming in the area consists mainly of growing small grain, mainly wheat, and raising cattle. Some subdivision development is taking place in the vicinity of Elizabeth and a smaller amount in the eastern part of the survey area.

General nature of the area

This section gives general information concerning the survey area. It discusses history and development; physiography, drainage, and relief; natural resources; farming; and climate.

History and development

There was very little settlement in Elbert County before 1854 (*2*). The first permanent settlements were established in 1859. Kiowa was established as a stagecoach station on the Smoky Hills Trail in 1859. The Gold Rush and growth of Denver and Colorado City (Colorado Springs) resulted in the establishment of sawmills in the timbered areas. These sawmills created a job market and a base for the towns of Elbert (1860) and Elizabeth (1855). Later the mills furnished ties for the developing railroads. Simla was established in the 1880's on the Rock Island Railroad. Elbert County was formed in 1874 and extended eastward to the State of Kansas. The present eastern boundary of Elbert County was established in 1889.

The Homestead Act of 1862 encouraged settlement of Elbert County. Early settlers were ranchers. Many had come during the Gold Rush and stayed. They brought their families and established permanent homes. They built adjacent to the major drainages where water was available and grazed cattle on the open government land. Large ranches were predominant in the 1860's and 1870's. Texas longhorns were the original stock but were gradually replaced with other breeds and sometimes with sheep.

The ordered removal of fences from government lands in 1855, coupled with the panic of 1893 and the building of railroads, speeded the breaking up of large ranches. This opened up the area to many homesteaders for farming. These farms averaged less than 640 acres in size. Potatoes were an important crop until about 1908 when they became infested with potato blight. Pinto beans replaced the potato as an important money crop, especially during the war years of 1917 and 1918. Small grains and corn were grown for feed; and some melons, squash, pumpkins, and root vegetables were marketed. Dairy herds were common.

Many who owned these small farms were forced out by the drought and dust storms of the 1930's. A major flood in 1935 caused much damage in Elbert and Kiowa. It washed out buildings and track of the Colorado and Southern Railroad, which was abandoned. Another flood in 1965 did considerable damage along the Bijou Creek drainage.

After several years of decline in population and industry, 1970 brought a surge of activity to Elbert County. The growing population along the foothills between Denver and Colorado Springs spread into Elbert County. Rolling grasslands and pine-covered hills made the area very desirable for housing development.

In 1977 the main industry in Elbert County was farming. It consisted of growing small grains, alfalfa, and forage sorghums and raising beef cattle. Wheat and beef are the main products.

Some small areas of the county are irrigated, but most of the area consists of dryland farms and rangeland. The large forests of ponderosa pine have been timbered out leaving mostly second growth.

Water supplies west of the West Bijou Creek are adequate for most purposes. East of West Bijou Creek, household and stock water supplies are usually adequate but occur deeper underground and are harder to locate.

There is some oil in the north-central part of the area. A bed of poor grade lignite coal along the eastern side of the area shows promise for strip mining.

Elbert County, Western Part, is a foothill area of rolling grasslands. Extremes in temperature; short duration, heavy rainfall; blizzards; and prolonged dry spells are hazards to farming and contribute to erosion. In recent years, construction of many small dams, seeding of former cropland to grass, better farming methods, establishment of farmstead windbreaks, and construction of the Kiowa Creek Watershed Project have all helped to stabilize the soil, preserve water, and diminish flood damage in the area.

Physiography, drainage, and relief

The western part of Elbert County lies entirely within the Colorado Piedmont section of the Great Plains physiographic province. Total relief of the area is approximately 2,030 feet. The highest point, which is near the southwest corner of the survey area, is about 7,350 feet above mean sea level. The lowest point, which is near the junction of Middle Bijou and Wilson Creeks at the northeastern corner of the area, is about 5;320 feet above mean sea level.

The survey area is drained mainly by tributaries of the South Platte River. These include Coal Creek, Running Creek, Kiowa Creek, West Bijou Creek, Middle Bijou Creek, Wilson Creek, and East Bijou Creek. The southeastern corner of the area is drained by Big Sandy Creek, which is a tributary of the Arkansas River.

Most of the area is characterized by broadly rolling topography. The major streams are on moderately wide flood plains and are generally separated by broad interstream divides. Numerous short drainageways lead into the large valleys, so that the surface relief of the upland areas ranges from undulating to hilly. In the southwestern part of the area, the valleys of Kiowa and West Bijou Creek area bordered in places by steep escarpments formed in resistant beds of conglomeratic sandstone.

Natural resources

Soil, surface and underground water, and native vegetation are major natural resources of the western part of Elbert County. One of the purposes of this survey is to help maintain the value of the soils as a resource. Identifying the different soils and describing their properties help to make this possible.

Several creeks draining from south to north through the area are sources of surface water. In the western part of the survey area, sources of underground water are rather extensive aquifers in the upper member of the Dawson Formation. In the eastern part of the survey area, aquifers are seldom found in the underlying lower member of the Dawson Formation and are usually limited to alluvium in drainage bottoms. Development in the western part of the survey area is encouraged by the more available underground water and the variety of vegetation, including some timber.

Rangeland is the most important agricultural resource in this area and is used for cattle production, the main industry. Where the soil is used for crop production, careful management is needed to prevent erosion.

Some of the kaolinitic clay in the area is mined for brick production in Denver.

Principal game animals are mule deer, antelope, coyote, bobcat, and cottontail.

Conservation of natural resources is important for continued farming and for maintaining the desirability of the area for its dwellers.

Farming

The early settlers of Elbert County were mainly cattle ranchers, but there was some farming along streams and valleys (*4*). A farming community between Calhan and Fondis was started in the 1880's by a group of Czechoslovakians. It covered about 30 square miles, with about 40 families in the area at one time. They grew pinto beans, corn, and wheat.

Farmers from the East and Midwest were moving to the county by the 1890's and because there was less moisture than in the areas where they had originated, they needed to learn such new farming methods as less tillage, rotation, and summer fallow.

Around the turn of the century, the average grain farm was no more than a section, and many were no larger than 320 acres. Besides wheat, barley, and small acreages of pinto beans and corn, potatoes were grown in Elbert County near the towns of Elbert and Elizabeth. For many years, potatoes were one of the most profitable money crops. Potato bakes were held in Elbert in and around 1900 to publicize the potato in the area. By 1908, however, potato blight had devastated potatoes in this area, and farmers switched to small grains.

Smaller acreages of squash, pumpkins, watermelons, muskmelons, and root vegetables were also produced and shipped to Denver and Colorado Springs.

The Kiowa Soil Conservation District was organized in 1941 and, after several additions, consisted of 465,250 acres and approximately 300 farms in the western part of the survey area. The remaining acreage of the survey area is covered by the Agate Soil Conservation District and Double El Soil Conservation District. The Agate SCD was organized in 1940, and the Big Sandy SCD was organized in 1939. In 1971 the Big Sandy and Horse-Rush SCD's were combined and renamed the Double El SCD. Today approximately 75,000 acres, or 12 percent of the survey area, is cropland. Except for an estimated 3,300 acres, the cropland is nonirrigated. Wheat is grown on the majority of cropland in the county today, with small amounts of ensilage corn, sorghum, and barley.

Farming potential is limited by the short growing season, absence of precipitation and irrigation water, and extreme weather conditions. Periods of severe drought occurred during the 1930's and 1950's. During these periods crop production was low, and the greater part of land in the survey area was damaged by wind erosion.

Climate

Data for this section were obtained from the National Climatic Center, Asheville, North Carolina.

Elbert County is generally warm in summer with frequent hot days. In winter, periods of very cold weather are caused by Arctic air moving in from the north or northeast. Cold periods alternate with milder periods that occur when westerly winds are warmed as they move downslope. Most precipitation falls as rain during the warmer part of the year and is normally heaviest late in spring and early in summer. Winter snowfalls are frequent, but snow cover disappears during mild periods.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Elbert, Colorado for the period 1963 to 1974. 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 most of the county, the average temperature in winter is 30 degrees F, and the average daily minimum is 13.7 degrees. The lowest temperature on record, -38 degrees, occurred at Parker 7E on January 12, 1963. In summer the average temperature is 67.6 degrees, and the average daily maximum is 83.8 degrees. The highest temperature, 103 degrees, was recorded on June 23, 1954.

In the higher southwest, the average temperature in winter is 26.7 degrees F, and the average daily minimum is 9.7 degrees. The lowest temperature on record, -39 degrees, occurred at Elbert on January 12, 1963. In summer the average temperature is 63.5 degrees, and the average daily maximum is 79.6 degrees. The highest temperature, 98 degrees, was recorded on July 12, 1971.

Growing degree days, shown in table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 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.

Of the total annual precipitation, 10 to 13 inches, or about 75 percent, usually falls during the period April through September, which includes the growing season for most crops. Two years in ten, the April-September rainfall is less than 7.14 inches at Parker and 9.55 inches at Elbert. The heaviest 1-day rainfall during the period of record was 3.60 inches at Parker 7E on May 6, 1973. Thunderstorms number about 48 each year, 35 of which occur in summer.

Average seasonal snowfall is 60 to 70 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 22 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon in spring is less than 36 percent. During the rest of the year it is about 41 percent. Humidity is higher at night in all seasons, and the average at dawn is about 69 percent. The percentage of possible sunshine is 71 percent in summer and 70 percent in winter. The prevailing direction of the wind is from the south. Average windspeed is highest, about 12 miles per hour, in April.

In some years during winter, a heavy blizzard with high winds and drifting snow strikes the county, and snow remains on the ground for many weeks. In some years during summer, hailstorms cause severe local damage to crops in the county.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Bresser-Truckton

Deep, nearly level to moderately steep, well drained loamy soils that formed in material weathered from noncalcareous arkosic sandstone

Areas of these soils are mainly in the northwestern and west-central parts of the survey area, but some smaller areas are scattered throughout the northeastern part. This map unit is on upland terraces, hills, and ridges.

This map unit makes up about 36 percent of the area. It is about 60 percent Bresser soils, 15 percent Truckton soils, and the rest is soils of minor extent.

The Bresser and Truckton soils have a sandy loam surface layer. Bresser soils have a sandy clay loam subsoil, and Truckton soils have a sandy loam subsoil.

The soils of minor extent are Ascalon, Baca, Stapleton, Weld, and Wiley soils. They are well drained.

The soils in this map unit are used mainly for grazing livestock, but some, mainly in the western part of the area, are cultivated. Wheat is the main nonirrigated crop. Small acreages of alfalfa, corn, and sorghum are also grown.

Control of wind and water erosion is the main concern on nonirrigated cropland. Management practices that conserve soil moisture and control erosion are essential. The shortage or absence of water limits the potential for irrigated cropland. The potential for urban uses is good. The potential for the development of openland and rangeland wildlife is fair.

Wildlife is an important secondary use of the soils in this map unit. In cropland areas, habitat suitable for ring-necked pheasant, mourning dove, and miscellaneous nongame species can be developed by establishing wildlife areas for nesting and escape cover. Rangeland wildlife, such as antelope and sharp-tailed grouse, can be increased by developing livestock watering facilities, using proper livestock grazing management, and seeding range where needed.

2. Weld-Bresser

Deep, nearly level to moderately sloping, well drained loamy soils that formed in calcareous eolian material and in noncalcareous material weathered from arkosic sandstone

Areas of these soils are scattered throughout the northwestern and west-central parts of the survey area. This map unit is on upland tablelands, hills, and ridges.

This map unit makes up about 4 percent of the area. It is about 65 percent Weld soils, 25 percent Bresser soils, and the rest is soils of minor extent.

Weld soils are on upland tablelands and formed in silty eolian material. Bresser soils are on upland terraces, hills, and ridges and formed in material weathered from arkosic sedimentary rock. Weld soils have a loam surface layer and a clay subsoil. Bresser soils have a sandy loam surface layer and a sandy clay loam subsoil.

The soils of minor extent are the Baca, Kutch, and Wiley soils. Also included are small areas of soils that are similar to the Fondis soils and mapped in the adjoining Castle Rock Area survey. These soils are well drained. The Baca, Fondis, and Wiley soils are deep. Kutch soils are underlain by shale at a depth of 20 to 40 inches.

The soils in this map unit are used for nonirrigated cropland and livestock grazing. Wheat is the main crop grown, but small acreages of oats and barley are also grown. Wind and water erosion are the main management concerns.

The absence of water limits the potential for irrigated cropland. The potential for urban uses is fair to good, but in the Weld soils it is limited because of the high shrink-swell potential and slow permeability of the subsoil. The potential for openland and rangeland wildlife is fair on the Bresser soils. On the Weld soils the potential for openland wildlife is fair and for rangeland wildlife it is poor.

Openland wildlife, such as pheasants, mourning doves, and cottontails, are best adapted to soils on which crops are growing. Wildlife habitat development, including tree and shrub plantings, as well as grass-legume seeding, may be successful without irrigation during most years. With irrigation, wildlife habitat developments that would benefit many kinds of openland wildlife could be established. Where soils are used for rangeland, antelope and mule deer could be benefited by good range management, including development of livestock watering facilities, livestock grazing management, and seeding range where necessary.

3. Kutch-Bresser-Cushman

Moderately deep and deep, gently sloping to moderately steep, well drained loamy soils that formed in calcareous shale, noncalcareous material weathered from arkosic sandstone, and calcareous interbedded shale and sandstone

Areas of these gently sloping to moderately steep soils are mainly in the eastern half of the survey area. This map unit is on hills, ridges, and valley side slopes.

This map unit makes up about 19 percent of the area. It is about 30 percent Kutch soils, 20 percent Bresser soils, 15 percent Cushman soils, and the rest is soils of minor extent.

The major soils are well drained. The Kutch soils are moderately deep over shale at a depth of 20 to 40 inches. They have a clay loam surface layer and a heavy clay loam and clay subsoil. The Bresser soils are deep and formed in material weathered from arkosic sedimentary rock. They have a sandy loam surface layer and a sandy clay loam subsoil. The Cushman soils are moderately deep over interbedded shale and sandstone at a depth of 20 to 40 inches. They have a loam surface layer and a clay loam subsoil.

The soils of minor extent are Louviers, Nunn, and Renohill soils and Torriorthents.

The soils in this map unit are used mainly for grazing livestock and for wildlife. Some small, scattered areas of soils on the more gentle slopes are used for nonirrigated cropland. Wheat and some corn and sorghum are the main crops.

The potential for irrigated cropland is poor because of the absence of available water and because of steep slopes. The soils in this map unit are well suited to grazing. The potential for urban uses is poor on the Kutch and Cushman soils because of the depth to bedrock and steep slopes. Potential for urban uses on the Bresser soils ranges from good to poor, depending on slope. The potential for rangeland wildlife is fair for all the soils. The potential for openland wildlife is fair on the Bresser and Cushman soils and poor on the Kutch soils.

Rangeland wildlife, such as antelope and sharp-tailed grouse, are best adapted to the soils in this unit where the main land use is livestock grazing. Hillsides and draws also furnish habitat for mule deer.

4. Nunn-Haplustolls

Deep, nearly level and gently sloping, well drained loamy soils that formed in calcareous clayey and loamy alluvium

These nearly level to gently sloping soils are on bottom lands, low terraces, fans, and toe slopes. They are mainly along the West Bijou, East Bijou, and Big Sandy drainageways.

This map unit makes up about 8 percent of the area. It is about 55 percent Nunn soils, 30 percent Haplustolls, and the rest is soils of minor extent.

Nunn soils are in a higher position on the landscape than the Haplustolls. Nunn soils have a clay loam surface layer and a clay or heavy clay loam subsoil. Haplustolls range in surface texture from loamy sand to loam. The underlying material is stratified with texture ranging from sand to clay loam.

The soils of minor extent are the somewhat excessively drained Ellicott soils, the well drained Englewood and Heldt soils, and the poorly drained Fluvaquents.

The soils in this map unit are used mainly for grazing, but some areas are used for sprinkler irrigated and nonirrigated cropland. They are also used as wildlife habitat. Crops grown are alfalfa, small grains, corn, forage sorghums, and beans. Occasional to rare flooding on the Haplustolls is the main limitation for farming and urban uses.

When adequately treated, the soils in this unit have good potential for nonirrigated cropland and for irrigated cropland, where underground water is available. The potential for urban uses ranges from poor to fair depending on flood hazard. The potential for wildlife habitat is fair.

The soils in this unit can furnish habitat for a variety of wildlife, ranging from mule deer to mourning dove. The presence of some dryland and irrigated farming enhances opportunities to develop wildlife habitats. Occasional flooding, while limiting the development of farming and urban uses on some of the soils in this unit, does help insure the availability of water for wildlife habitat.

5. Wiley-Baca-Weld

Deep, nearly level to moderately sloping, well drained loamy soils that formed in calcareous eolian material

Areas of these nearly level to moderately sloping soils are mainly in the northeastern part of the survey area. They are on hills, ridges, benches, toe slopes, and tablelands.

This map unit makes up 7 percent of the area. It is about 25 percent Wiley soils, 20 percent Baca soils, 20 percent Weld soils, and the rest is soils of minor extent.

Wiley and Baca soils generally are in the higher and more sloping areas. The Weld soils are mainly on the more level tablelands. Each of the soils has a loam surface layer. The Wiley soils have a silty clay loam subsoil, the Baca soils have a clay loam subsoil, and the Weld soils have a clay subsoil.

The soils of minor extent are the deep, well drained Ascalon, Bresser, and Truckton soils and the moderately deep Cushman soils.

The soils in this unit are used for nonirrigated cropland and for grazing. Small grains and sorghums are the main crops grown. Wind and water erosion are the main management concerns.

The shortage of water limits the potential for irrigated cropland. The soils in this map unit have good potential for urban uses, although the Baca and Weld soils are limited by high shrink-swell potential and a slowly permeable subsoil. The potential for development of openland wildlife is fair and for rangeland wildlife it is poor.

Openland wildlife, such as ring-necked pheasant, mourning dove, and cottontail, are best adapted to the soils in this unit. The interspersion of cropland and rangeland provides the edge effect, which attracts many kinds of wildlife.

6. Cushman-Ascalon

Moderately deep and deep, nearly level to strongly sloping, well drained loamy soils that formed in calcareous interbedded shale and sandstone and in calcareous loamy alluvium

Areas of these nearly level to strongly sloping soils are scattered throughout the eastern part of the survey area. They are on hills, valley side slopes, and rolling uplands.

This map unit makes up about 11 percent of the area. It is about 40 percent Cushman soils, 25 percent Ascalon soils, and the rest is soils of minor extent.

Cushman soils are generally on hills and in higher positions on the slopes than the Ascalon soils. Cushman soils are moderately deep. They have a loam surface layer, a clay loam and silty clay loam subsoil, and interbedded shale and sandstone bedrock at a depth of 20 to 40 inches. Ascalon soils are deep, have a sandy loam surface layer, and have a sandy clay loam subsoil.

The soils of minor extent are the deep, well drained Bresser, Nunn, and Truckton soils and the moderately deep, well drained Kutch and Renohill soils.

The soils in this map unit are used mainly for grazing and nonirrigated cropland. Most of the cropland is on the nearly level to gently sloping areas west and north of the town of Simla. Small grains, forage sorghums, and alfalfa are the main crops grown. Wind and water erosion are the main management concerns on these soils.

The potential for irrigated cropland is poor because of the absence of available water. The potential for urban uses ranges from good to poor. Depth to bedrock and slope are the main limitations. The potential for openland and rangeland wildlife habitat is fair.

Depending on the land use, the soils in this map unit are used by openland species that tend to use cropland or rangeland. In areas where crops are grown, wildlife habitat can be developed that would enhance openland wildlife, such as ring-necked pheasant, cottontail, and mourning dove. Range wildlife, typified by the antelope, can be increased by the development of livestock grazing and seeding range where necessary.

7. Brussett-Peyton-Elbeth

Deep, nearly level to moderately steep, well drained loamy soils that formed in calcareous loess and in non-calcareous material weathered from arkosic sandstone

Areas of these nearly level to moderately steep soils are mainly in the southwest corner of the survey area. A few areas are scattered throughout. Brussett and Peyton soils are in the open grassland areas and the Elbeth soils are in the woodland areas.

This map unit makes up about 15 percent of the area. It is about 20 percent Brussett soils, 20 percent Peyton soils, 15 percent Elbeth soils, and the rest is soils of minor extent.

The Brussett soils are on the tablelands. Peyton soils are on side slopes, fans, hills, and ridges. Elbeth soils are on hills and ridges. Brussett soils have a loam surface layer and a clay loam subsoil. Peyton and Elbeth soils have a sandy loam surface layer and a sandy clay loam subsoil.

The soils of minor extent are the deep, well drained Holderness and Pring soils, the well drained to somewhat excessively drained Kettle soils, the moderately deep, well drained Bluerim soils, and the shallow, well drained Coni soils.

The soils in this map unit are used for nonirrigated cropland, grazing, woodland, and homesites. The main crops grown are wheat and oats. The short growing season limits the type of crops grown.

The potential for irrigated cropland is poor because of the absence of available water. The potential for urban uses is good, except where steep slopes are a limitation. The potential for openland and rangeland wildlife habitat is fair. The potential for woodland and rangeland wildlife habitat on the Elbeth soils is good.

Openland and rangeland wildlife species are favored on the Brussett and Peyton soils. Where cropland and rangeland are interspersed, both kinds of wildlife are favored. Woodland wildlife, including mule deer and wild turkey, are best adapted to the forest habitat found on the Elbeth soils.

Broad land use considerations

The western part of Elbert County is a diversified agricultural area used primarily for rangeland and nonirrigated cropland. A few small areas, mostly along the major drainageways, including Boxelder, Kiowa, Comanche, West Bijou, and Big Sandy Creeks, are used for sprinkler irrigated cropland. Small acreages, approximately 11,000 acres, or nearly 2 percent of the area, are being developed for urban uses. Most of the urban development is in the vicinity of Elizabeth with smaller acreages in the northeastern part of the survey area and near the town of Elbert. Several areas of nonirrigated cropland, especially where erosion has been severe, have been seeded to grass and are used for grazing. The general soil map is helpful for planning the general outline of major land uses in the survey area.

All map units, with minor exceptions, are well suited to rangeland use. The potential for continued productive grazing on rangeland can be maintained and improved by using range management practices.

Most areas suitable for nonirrigated cropland are being used for this purpose. The most extensive acreages of nonirrigated cropland are located in the Bresser-Truckton, Weld-Bresser, Wiley-Baca-Weld, Cushman-Ascalon, and Brussett-Peyton-Elbeth map units. Choice of crops in the Brussett-Peyton-Elbeth map unit is limited because of cool temperatures and the short growing season. The potential for additional nonirrigated cropland in the survey area is limited to scattered small tracts of deep, gently sloping soils in the other soil areas. Areas of the Kutch-Bresser-Cushman and Nunn-Haplustolls map units are arable, but they generally are too small and scattered for nonirrigated cropland operations.

Potential for additional irrigated cropland development is limited by the availability of underground water.

Areas where the soils are so unfavorable that urban development is prohibitive are not extensive in the survey area. Areas of the Kutch-Bresser-Cushman and Cushman-Ascalon map units are limited by shale or sandstone at a depth of 10 to 40 inches and by steep slopes. The Nunn-Haplustolls map unit contains soils that are subject to flooding and shrinking and swelling.

Areas of the Brussett-Peyton-Elbeth map unit have soils that are severely limited because of shallow depth to bedrock and steep slopes. Regardless of these severe limitations, the soils in this unit are very popular as building sites because of the esthetic value. Areas of the Brussett-Peyton-Elbeth map unit are used for woodland. The main wood products produced are firewood, posts, and poles.

Potential for wildlife habitat varies in the survey area. The Elbeth part of the Brussett-Peyton-Elbeth map unit has good potential for woodland wildlife habitat. The Brussett and Peyton parts have fair potential for openland and rangeland wildlife habitats. The Wiley-Baca-Weld map unit has fair potential for openland wildlife habitat and poor potential for rangeland wildlife habitat. The Cushman and Kutch parts of the Kutch-Bressser-Cushman and Cushman-Ascalon map units have very poor and poor potential for openland wildlife habitat. The Ascalon and Bresser parts have fair potential. Both map units have fair potential for rangeland wildlife habitat. The Bresser-Truckton, Weld-Bresser, and Nunn-Haplustolls map units have fair potential for both openland and rangeland wildlife habitats. The Weld part, however, has poor potential for rangeland wildlife habitat.

Wildlife habitat development is an important land use, especially in small isolated areas. It should not be overlooked in any area.

Most of the soils have fair or good potential for windbreak plantings. Exceptions are the Kutch-Bresser-Cushman and Cushman-Ascalon map units of which the Cushman and Kutch soils are limited by depth to bedrock.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named (*6*). Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Bresser sandy loam, 0 to 4 percent slopes, is one of several phases within the Bresser series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Cushman-Kutch complex, 8 to 25 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. There are no associations in this survey area.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. There are no undifferentiated groups in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

This survey was mapped at two levels of detail. At the most detailed level, map units are narrowly defined. This means that soil boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Soil boundaries were plotted and verified at wider intervals. The broadly defined units are indicated by an asterisk in the soil map legend. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1—Ascalon sandy loam, 0 to 4 percent slopes. This deep, well drained soil is on upland ridges and benches. It formed in calcareous alluvium. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 145 days.

Included with this soil in mapping are small areas of Bresser sandy loam and Cushman loam that have 0 to 4 percent slopes.

Typically, the surface layer is grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam to a depth of about 22 inches. The substratum is pale brown sandy loam and yellowish brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used mainly for nonirrigated cropland. The typical rotation is wheat and summer fallow. The estimated potential yield for wheat is about 20 bushels per acre. Most of the remaining acreage is used for grazing. Some areas of this soil are being used for homesites and other urban uses.

Conserving moisture and protecting the soil from blowing are the main management concerns on nonirrigated cropland. Summer fallow is necessary because of insufficient precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect the soil from erosion, to improve soil tilth, and to conserve moisture. Chiseling breaks up tillage pans and improves water infiltration in the subsoil. Stripcropping and using windbreak plantings at right angles to the prevailing wind are also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, sideoats grama, and little bluestem. When range condition deteriorates because of overgrazing or some other use, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range to native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, is recommended to revegetate depleted areas. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass can also be used.

This soil is well suited to homesites and other urban uses. It has only minor limitations that can be easily overcome. Where this soil is used for a sewage lagoon system, special sealing methods are needed to overcome the excessive seepage condition.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. It can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

This soil is in capability subclass IIIe, nonirrigated.

2—Ascalon sandy loam, 4 to 8 percent slopes. This deep, well drained soil is on upland ridges and side slopes. It formed in moderately coarse textured calcareous material. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 145 days.

Included with this soil in mapping are small areas of Bresser sandy loam and Truckton sandy loam that have slopes of 4 to 8 percent. Also included is Cushman-Ascalon complex, 4 to 15 percent slopes.

Typically, the surface layer is grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam to a depth of about 22 inches. The substratum is pale brown sandy loam and yellowish brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

About half of this soil is used for nonirrigated cropland. Wheat is the main crop. The estimated potential yield for wheat is about 17 bushels per acre. Most of the remaining acreage is used for grazing. Some areas of this soil are being used for homesites and other urban uses.

Conserving moisture and protecting the soils from erosion are the main concerns of management. Summer fallow is necessary because of insufficient precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect soil from erosion, to improve soil tilth, and to conserve moisture. Terracing also helps in stabilizing the soil and holding needed moisture. Chiseling breaks up tillage pans and improves water infiltration in the subsoil. Stripcropping and windbreak plantings at right angles to the prevailing wind are also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum. Intensive use of these practices is essential to protect this soil and maintain productivity.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, little bluestem, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

This soil is well suited to homesites and other urban uses. It has only minor limitations that can be easily overcome. Where this soil is used for a sewage lagoon system, special sealing methods are required to overcome excessive seepage.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

This soil is in capability subclass IVe, nonirrigated.

3—Baca-Wiley loams, 0 to 4 percent slopes. These nearly level to gently sloping soils are on upland terraces, hilltops, and side slopes. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average air temperature is about 47 degrees F, and average frost-free period is about 145 days. The Baca soil makes up about 45 percent of the unit, and the Wiley soil about 35 percent.

Included with these soils in mapping are small areas of Ascalon sandy loam and Weld loam that have 0 to 4 percent slopes and small intermittent lakes.

The Baca soil is deep and well drained. It formed in calcareous eolian material. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil to a depth of about 27 inches ranges from yellowish brown to pale brown. It is heavy clay loam and is calcareous in the lower part. The substratum is very pale brown silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

The Wiley soil is deep and well drained. It formed in calcareous silty eolian material. Typically, the surface layer is brown loam about 3 inches thick. The subsoil is very pale brown silty clay loam to a depth of about 29 inches. The substratum is very pale brown silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight to moderate.

Most of the soils in this unit are used for nonirrigated cropland. Wheat and forage sorghums are the main crops. A typical rotation is wheat and summer fallow. The estimated yield for wheat is about 18 bushels per acre. Summer fallow is necessary because of insufficient rainfall. The remaining acreage is used for grazing. It has good potential for windbreaks and environmental plantings. It has fair to good potential for most engineering uses.

Intensive management is needed on nonirrigated cropland to control erosion, conserve moisture, and maintain soil productivity. Stubble mulch tillage and incorporating crop residue in and on the surface is essential in improving soil tilth, conserving moisture, and protecting the soil from erosion. Chiseling or subsoiling is effective in breaking up tillage pans and improving water penetration. Stripcropping at right angles to the prevailing wind is also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly blue grama, needleandthread, sideoats grama, prairie junegrass, and western wheatgrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses are desirable for range seeding, but tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass or intermediate wheatgrass, can also be used.

These soils are well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Moderate shrink-swell potential and low strength are the main limiting soil properties for homesites and other urban uses. These limitations can be modified by special engineering design.

These soils are in capability subclass IIIe, nonirrigated.

4—Bluerim-Peyton sandy loams, 8 to 20 percent slopes. These moderately sloping to moderately steep soils are on upland hills and ridges. Average annual precipitation ranges from about 16 to 19 inches, and average annual air temperature is about 43 degrees F. Bluerim soils make up about 45 percent of the unit and Peyton soils about 35 percent. The Bluerim soils are on the steeper, upper side slopes, narrow ridgetops, and on moderately sloping areas below rock outcrops. The Peyton soils are on side slopes, fans, hills, and ridges.

Included with these soils in mapping, and making up about 20 percent of the unit, are Elbeth-Kettle complex, 8 to 25 percent slopes; shallow, clayey soils over shale; and sandstone rock outcrop.

The Bluerim soils are moderately deep and well drained. They formed in residuum weathered from interbedded sandstone and shale. Typically, the surface layer is light olive brown sandy loam about 5 inches thick. The subsoil is light olive brown sandy clay loam to a depth of about 31 inches. Soft interbedded sandstone and shale is at a depth of about 31 inches.

Permeability and available water capacity are moderate. The effective rooting depth is 20 to 40 inches. Surface runoff ranges from medium to rapid, and the hazard of erosion ranges from moderate to high.

The Peyton soils are deep and well drained. They formed in arkosic alluvium and residuum. Typically, the surface layer, about 7 inches thick, is grayish brown sandy loam in the upper 3 inches and dark grayish brown light sandy clay loam in the lower 4 inches. The subsoil, to a depth of about 32 inches, is sandy clay loam. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum is light brownish gray and white, coarse sandy loam and loamy coarse sand to a depth of 60 inches or more.

Permeability is moderate, and available water capacity ranges from moderate to high. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this unit are used mainly for grazing and wildlife habitat. Some small areas are used for homesites.

Rangeland vegetation is mainly prairie sandreed, mountain muhly, needleandthread, little bluestem, western wheatgrass, and blue grama. When range condition deteriorates because of overgrazing or some other use, Kentucky bluegrass, hairy goldaster, and Gambel oak invade.

Seeding the range to revegetate depleted areas to native grasses, such as prairie sandreed, little bluestem, and sand bluestem, is recommended. Tame grasses, such as Nordan crested wheat and smooth brome, can also be used. Scattered ponderosa pine trees are common on the Bluerim soils.

The Bluerim soils are generally unsuited to windbreaks and environmental plantings. Onsite investigation is needed to determine what special planting practices are needed to insure survival. The Peyton soils are generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

The depth to sandstone and shale and slope are the main limiting soil features of the Bluerim soils, where they are used for homesites and other urban purposes. Special engineering designs and measures are needed for dwellings with basements because of the depth to bedrock and slope. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields do not function properly because of the depth to bedrock. Slope is the main limitation of the Peyton soils. Intensive engineering designs and measures are needed because of the slope limitation.

These soils are in capability subclass VIe, nonirrigated.

5—Bresser sandy loam, 0 to 4 percent slopes. This deep, well drained soil formed in alluvium and residuum weathered from arkosic sedimentary rock. It is on hills and ridges. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Ascalon sandy loam, Truckton sandy loam, and Weld loam that have 0 to 4 percent slopes. Also included are a few small intermittent lakes.

Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The subsoil to a depth of about 29 inches is brown and pale brown sandy clay loam and sandy loam. The substratum is very pale brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for nonirrigated cropland. Wheat is the main crop, but some smaller acreages of forage sorghum and corn are also grown. The estimated yield for wheat is about 22 bushels per acre. Most of the remaining acreage is used for grazing. Some areas are used for homesites and other urban uses.

Conserving moisture and protecting the soil from blowing are the main concerns of management on nonirrigated cropland. Summer fallow is necessary because of the absence of adequate precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect soil from erosion, improve soil tilth, and conserve moisture. Chiseling breaks up tillage pans and improves water infiltration in the subsoil. Stripcropping and windbreak plantings at right angles to the prevailing wind are also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, little bluestem, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, can also be used.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

This soil is suited to homesites and other urban uses and has only minor limitations that can be easily overcome. Where this soil is used for a sewage lagoon system, special sealing methods are needed to overcome the excessive seepage condition.

This soil is in capability subclass IIIe, nonirrigated.

6—Bresser sandy loam, 4 to 8 percent slopes. This deep, well drained soil formed in alluvium and residuum weathered from arkosic sandstone. It is on gently rolling uplands and side slopes. Elevation ranges from about 5,300 to about 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 4 percent slopes. Also included are Ascalon sandy loam and Truckton sandy loam that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The subsoil is brown sandy clay loam to a depth of about 20 inches and pale brown sandy loam to a depth of about 29 inches. The substratum is very pale brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is medium, and the hazard of erosion is moderate. A few gullies are in some places.

Less than half of this soil is used for nonirrigated cropland. Wheat is the main crop. The estimated yield for wheat is about 17 bushels per acre. Most of the remaining acreage is used for grazing. Some areas of this soil are used for homesites and other urban purposes.

Conserving moisture and protecting the soil from erosion are the main concerns of management on nonirrigated cropland. Summer fallow is necessary because of the absence of adequate precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect soil from erosion, improve soil tilth, and conserve moisture. Chiseling breaks up tillage pans and improves water infiltration in the subsoil. Stripcropping at right angles to the prevailing wind is also effective in protecting the soil from blowing (figs. 1 to 4). Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, little bluestem, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

This soil is well suited for homesites and other urban uses and has only minor limitations that can be easily overcome. Where this soil is used for a sewage lagoon system, special sealing methods are needed to overcome the excessive seepage condition.

This soil is in capability subclass IVe, nonirrigated.

7—Bresser-Cushman complex, 4 to 20 percent slopes. These gently sloping to moderately steep soils are on valley side slopes and hills. Elevation ranges from 5,300 to 6,400 feet. Average annual precipiation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days. The Bresser soil makes up about 40 percent of the unit, and the Cushman soil makes up about 30 percent.

Included with this complex in mapping, and making up about 30 percent of the unit, are Ascalon sandy loam, Truckton sandy loam, and Kutch clay loam that have 4 to 8 percent slopes.

The Bresser soil is deep and well drained. It formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The subsoil is brown sandy clay loam to a depth of about 20 inches and pale brown sandy loam to a depth of about 29 inches. The substratum is very pale brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Cushman soil is moderately deep and well drained. It formed in mixed calcareous material weathered from interbedded shale and sandstone. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil is grayish brown clay loam to a depth of about 20 inches. The substratum is light brownish gray silty clay loam over interbedded shale and sandstone at a depth of about 34 inches.

Permeability and available water capacity are moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate. Some gullying has taken place in drainageways.

Most of the soils in this unit are used for grazing. Small areas on the lower parts of slopes have been used for nonirrigated cropland, but most areas have been seeded to grass. The Bresser soil has good potential for windbreaks and environmental plantings and for most engineering uses in selected areas. The Cushman soil has poor to fair potential for these uses.

Rangeland vegetation on the Bresser soil is mainly prairie sandreed, blue grama, little bluestem, sideoats grama, prairie junegrass, and needleandthread. Rangeland vegetation on the Cushman soil consists mainly of blue grama, green needlegrass, sideoats grama, and western wheatgrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

The Bresser soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

The Cushman soil is not generally suited to windbreaks or environmental plantings because of the limited available water capacity and rooting depth. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival of the plantings.

The Bresser soil is well suited to homesites and other urban uses and has only minor limitations that can be easily overcome, except for the steeper slopes. Special engineering designs are needed to overcome the limitation of slopes more than 8 percent. The Cushman soil is limited by moderate depth to bedrock and by slopes that exceed 8 percent. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields and sewage lagoons will not function properly because of bedrock and slope.

This complex is in capability subclass VIe, nonirrigated.

8—Bresser-Stapleton sandy loams, 8 to 25 percent slopes. These deep, well drained soils are on gently rolling and hilly ridges and valley side slopes. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Bresser soil makes up about 50 percent of the unit and the Stapleton soil makes up about 25 percent. The Bresser soil is on the wider ridgetops and the more rolling side slopes. The Stapleton soil is on the narrow ridgetops and steeper ridges and side slopes.

Included with these soils in mapping and making up about 25 percent of the unit, are small areas of Cushman loam and Weld loam that have 4 to 8 percent slopes. Also included are shallow, loamy soils over interbedded shale and sandstone and sandstone outcrops on steep banks along narrow drainageways.

The Bresser soil formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The subsoil to a depth of about 29 inches is brown and pale brown sandy clay loam and sandy loam. The substratum is very pale brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Stapleton soil formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is dark gray sandy loam about 12 inches thick. The subsoil is grayish brown coarse sandy loam to a depth of about 37 inches. The substratum is light gray gravelly loamy sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate. Gullying has taken place throughout the unit, mainly along stock trails.

Most of the soils in this unit are used for grazing. They have poor potential for cropland. They have fair to good potential for wildlife habitat and for most engineering uses.

Rangeland vegetation is mainly blue grama, prairie sandreed, little bluestem, needleandthread, prairie junegrass, western wheatgrass, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

These soils are generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

Where these soils are used for homesites and other urban purposes, the main limitation is steep slopes. Special planning and designs are used to overcome this limitation and other minor ones.

These soils are in capability subclass VIe, nonirrigated.

9—Bresser-Truckton sandy loams, 8 to 25 percent slopes. These deep, well drained soils are on gently rolling and hilly ridges and valley side slopes. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation is 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Bresser soil makes up about 45 percent of the unit and the Truckton soil about 35 percent.

Included with these soils in mapping and making up about 10 percent of the unit, are small areas of Ascalon sandy loam, 4 to 8 percent slopes, and Cushman-Kutch complex, 8 to 25 percent slopes.

The Bresser soil formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The subsoil to a depth of 29 inches is brown and pale brown sandy clay loam and sandy loam. The substratum is very pale brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Truckton soil formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is brown sandy loam about 3 inches thick. The subsoil, to a depth of about 20 inches, is brown and yellowish brown sandy loam. The substratum is very pale brown loamy coarse sand to a depth of 60 inches.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate to high. Some gullying has taken place along stock trails and narrow drainageways.

The soils in this unit are used mostly for grazing. Other uses are for homesites and urban and recreational development. These soils are fairly suited to most engineering uses.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, western wheatgrass, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

These soils are generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

Where these soils are used for homesites and other urban purposes, the main limitation is steep slopes. Special planning and designs are used to overcome this limitation.

These soils are in capability subclass VIe, nonirrigated.

10—Brussett loam, 0 to 4 percent slopes. This deep, well drained soil is on tablelands. It formed in loamy eolian material. Elevation ranges from about 6,800 to 7,300 feet. Average annual precipitation is about 17 to 19 inches, average annual air temperature is about 43 degrees F, and the frost-free period is about 100 to 120 days.

Included with this soil in mapping are small areas of Holderness loam, 0 to 4 percent slopes; Peyton sandy loam, 4 to 8 percent slopes; and deep, dark loamy alluvial soils along drainageways and in swales.

Typically, the surface layer is grayish brown and dark grayish brown loam about 10 inches thick. The subsoil is brown and pale brown clay loam to a depth of 29 inches and light yellowish brown silty loam to a depth of 38 inches. The substratum is light yellowish brown silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for nonirrigated cropland. The remaining acreage is used for grazing and homesite and urban development. Wheat is the main crop grown in a crop-fallow system. The estimated yield for wheat is about 23 bushels per acre, and it is 30 bushels per acre for oats. The choice of crops is limited because of the short growing season. Potential for most engineering uses is fair to good.

Conserving moisture is the main concern of management on cropland. Summer fallow is necessary because of the limited precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to improve tilth and infiltration and to conserve moisture. Chiseling or subsoiling improves water penetration. Tillage operations need to be kept to a minimum. Terracing is also beneficial in conserving water and reducing runoff.

Rangeland vegetation is mainly mountain muhly, Arizona fescue, western wheatgrass, needleandthread, and prairie junegrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, mountain brome, and Arizona fescue, are recommended for range seeding.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

This soil is suited to homesites and other urban uses and has only minor limitations that can be easily modified.

This soil is in capability subclass IIIe, nonirrigated.

11—Brussett loam, 4 to 8 percent slopes. This deep, well drained soil is on tablelands. It formed in loamy eolian material. Elevation ranges from about 6,800 to 7,300 feet. Average annual precipitation is about 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 100 to 120 days.

Included with this soil in mapping are small areas of Coni loam, 4 to 15 percent slopes. Also included are Holderness loam and Peyton sandy loam that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown and dark grayish brown loam about 10 inches thick. The subsoil is brown and pale brown clay loam to a depth of about 29 inches and light yellowish brown silt loam to a depth of about 38 inches. The substratum is light yellowish brown silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for nonirrigated cropland. The remaining acreage is used for grazing and for homesites and other urban uses. Wheat is the main crop in a crop-fallow system. The estimated yield for wheat is about 20 bushels per acre, and it is 25 bushels per acre for oats. A choice of crops is limited because of the short growing season. Potential for most engineering uses is fair to good.

Controlling soil erosion, conserving moisture, and maintaining productivity are the main concerns of management on cropland. Summer fallow is necessary because of the limited precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to improve tillage, conserve moisture, and protect the soil from erosion. Chiseling or subsoiling is effective in breaking up tillage pans and improving water penetration. Terracing and contour tillage are needed to reduce runoff and conserve moisture. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly mountain muhly, Arizona fescue, western wheatgrass, needleandthread, and prairie junegrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, mountain brome, and Arizona fescue, are recommended for range seeding.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of the plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

This soil is suited to homesites and other urban uses and has only minor limitations that can be easily overcome.

This soil is in capability subclass IVe, nonirrigated.

12—Coni loam, 4 to 15 percent slopes. This shallow, gently sloping to strongly sloping, well drained soil is on upland hills and ridges. It formed in sediment of arkosic beds overlying hard cemented conglomerate. Elevation ranges from about 6,800 to 7,300 feet. Average annual precipitation is about 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Brussett loam and Holderness loam that have 0 to 4 and 4 to 8 percent slopes. Also included are Peyton sandy loam, 4 to 8 percent slopes, and sandstone and rhyolite rock outcrops. In places the rock outcrop is in the form of long, narrow, nearly vertical cliffs.

Typically, the surface layer is brown loam about 5 inches thick. The subsoil is brown loam and clay loam to a depth of about 19 inches and rests on hard conglomerate.

Permeability is moderate, and available water capacity is low. The effective rooting depth is less than 20 inches. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high, especially in the spring during snowmelt.

This soil is used mostly for grazing and wildlife habitat. The panoramic view from many areas of this map unit makes it popular for homesites and recreational areas. The soil has poor potential for cropland and most engineering uses.

Rangeland vegetation is mainly mountain muhly, Arizona fescue, western wheatgrass, needleandthread, Parry oatgrass, and prairie junegrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, mountain brome, and Arizona fescue, are recommended for range seeding.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

This soil has severe limitations for homesites and other urban uses because of the shallow depth to bedrock. Special onsite investigations are needed to select specific sites and to determine management.

This soil is in capability subclass VIe, nonirrigated.

13—Cushman loam, 0 to 4 percent slopes. This moderately deep, well drained soil is on upland hills, ridges, and valley side slopes. It formed in calcareous material weathered from interbedded shale and sandstone. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Ascalon sandy loam, Kutch clay loam, and Nunn clay loam that have 0 to 4 percent slopes.

Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil is grayish brown clay loam to a depth of about 20 inches. The substratum is light brownish gray silty clay loam to a depth of 34 inches. Below that is olive interbedded shale and sandstone.

Permeability is moderate, and available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is slow, and the hazard of erosion is moderate.

About half of this soil is used for irrigated cropland, and most of the remaining acreage is used for grazing. Several areas that were formerly cultivated have been seeded to grass. Wheat and forage sorghum are the main crops grown. The estimated yield for wheat is about 20 bushels per acre. This soil has poor to fair potential for most engineering uses.

The main concerns of management on nonirrigated cropland are conserving moisture and protecting the soil from erosion. Stubble mulch tillage and incorporating crop residue in and on the surface is essential in improving soil tilth, conserving moisture, and protecting the soil from erosion. Chiseling or subsoiling is effective in breaking up tillage pans and improving water penetration. Stripcropping at right angles to the prevailing wind is also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly blue grama, needlegrasses, sideoats grama, prairie junegrass, and western wheatgrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

The main limiting soil feature of this soil, where it is used for homesites or other urban uses, is the presence of sandstone and shale at a depth of 20 to 40 inches. Building sites and roads must be designed to overcome this limitation. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of the depth to bedrock.

This soil is in capability subclass IVe, nonirrigated.

14—Cushman-Ascalon complex, 4 to 15 percent slopes. These moderately deep and deep, well drained soils are on gently sloping to rolling upland hills, ridges, and valley side slopes. Slopes are mostly short and irregular. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Cushman soil makes up about 55 percent of the unit and the Ascalon soil about 30 percent. The Cushman soil is mainly on the ridgetops and steeper side slopes. The Ascalon soil is on the more gently sloping and moderately sloping side slopes and toe slopes.

Included with this complex in mapping, and making up about 15 percent of the unit, are Bresser sandy loam and Kutch clay loam that are on 4 to 8 percent slopes. Also included are Renohill-Louviers complex, 8 to 25 percent slopes, and small areas of shale and sandstone outcrops and gravelly ridges.

The Cushman soil is moderately deep and formed in calcareous material weathered from interbedded shale and sandstone. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil is grayish brown clay loam to a depth of about 20 inches. The substratum is light brownish gray silty clay loam to a depth of about 34 inches. Below that is olive interbedded shale and sandstone.

Permeability is moderate, and available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate to high. Some deep gullies have formed along drainageways and stock trails.

The Ascalon soil is deep and formed in calcareous alluvium. Typically, the surface layer is grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam to a depth of about 22 inches. The substratum is pale brown sandy loam and yellowish brown loamy sand to a depth of 60 inches.

Permeability and available water capacity are moderate. Surface runoff is medium, and the hazard of erosion is moderate.

Most of these soils are used for grazing. They have poor potential for cropland. The Cushman soil has poor potential for windbreaks and environmental plantings and poor to fair potential for most engineering uses. The Ascalon soil has good potential for windbreaks and environmental plantings and good to fair potential for most engineering uses.

Rangeland vegetation on the Cushman soil is blue grama, needlegrasses, prairie junegrass, sideoats grama, and western wheatgrass. Rangeland vegetation on the Ascalon soil is blue grama, prairie sandreed, needleandthread, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from erosion and soil blowing. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

The Cushman soil is generally unsuited to windbreaks and environmental plantings. Onsite investigation is needed to determine which special planting practices are needed to insure survival. The Ascalon soil is generally suited to windbreaks and environmental plantings. Soil blowing is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods.

The main limiting soil features of the Cushman soil, for use as homesites or other urban purposes, is the presence of sandstone and shale at a depth of 20 to 40 inches and steep slopes. Building sites and roads must be designed to overcome these features. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of the limiting soil features. The Ascalon soil is well suited to construction of homesites and other urban developments and has only minor limitations that can be easily modified. Special engineering designs are needed in order to compensate for slopes that are more than 8 percent.

This complex is in capability subclass VIe, nonirrigated.

15—Cushman-Hargreave complex, 8 to 15 percent slopes. These moderately deep, moderately sloping and strongly sloping, well drained soils are on upland hills, ridges, and bench edges. Slopes are mostly short and irregular. Elevation ranges from about 6,400 to 6,900 feet. Average annual precipitation is about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 125 days. The Cushman soil makes up about 40 percent of this complex and the Hargreave soil about 30 percent.

Included with this complex in mapping, and making up about 30 percent of the unit, are Bresser sandy loam, 4 to 8 percent slopes; Kutch-Louviers complex, 8 to 25 percent slopes; Truckton sandy loam, 4 to 8 percent slopes; and shallow, loamy sand soils over soft sandstone and sandy shale.

The Cushman soils formed in calcareous material weathered from interbedded shale and sandstone. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil is grayish brown clay loam to a depth of about 20 inches. The substratum is light brownish gray silty clay loam to a depth of about 34 inches. Below that is olive interbedded shale and sandstone.

Permeability is moderate, and available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate to high. Deep gullies have formed along some drainageways and stock trails.

The Hargreave soil formed in noncalcareous material weathered from soft sandstone. Typically, the surface layer is dark grayish brown cobbly sandy loam about 5 inches thick. The subsoil is grayish brown, brown, and pale brown sandy clay loam and sandy loam to a depth of about 18 inches. The substratum is very pale brown sandy loam to a depth of about 24 inches and rests on soft sandstone.

Permeability and available water capacity are moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate. Some gullying has taken place along drainageways and stock trails.

These soils are used mainly for grazing. They have poor potential for cropland, windbreaks, and environmental plantings and poor to fair potential for most engineering uses.

Rangeland vegetation is mainly blue grama, needlegrasses, sideoats grama, prairie junegrass, and western wheatgrass on the Cushman soils. Mountain muhly, big bluestem, little bluestem, blue grama, and sideoats grama are predominant on the Hargreave soils. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from erosion and soil blowing. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

These soils are generally not suited to windbreaks or environmental plantings. Onsite investigation is needed to determine which special planting practices are needed to insure survival.

The main limiting soil features of these soils, where they are used for homesites or other urban uses, are shale and sandstone at a depth of 20 to 40 inches and slope. Building sites and roads must be designed to offset these features. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of the limiting soil features.

This complex is in capability subclass VIe, nonirrigated.

16—Cushman-Kutch complex, 8 to 25 percent slopes. These moderately deep, well drained, moderately sloping to moderately steep soils are on upland hills, ridges, and side slopes. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days. The Cushman soil makes up about 50 percent of this unit and the Kutch soil about 30 percent.

Included with this complex in mapping, and making up about 20 percent of the unit, are Ascalon sandy loam, 4 to 8 percent slopes; Renohill-Louviers complex, 8 to 25 percent slopes; sandy soils that are similar to the Terry soils mapped in El Paso County; and sandstone outcrops (fig. 5).

The Cushman soil formed in calcareous material weathered from interbedded shale and sandstone. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil is grayish brown clay loam to a depth of about 20 inches. The substratum is light brownish gray silty clay to a depth of about 34 inches. Below that is olive interbedded shale and sandstone.

Permeability is moderate, and available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate to high. Deep gullies have formed along some drainageways and stock trails.

The Kutch soils formed in fine textured calcareous material weathered from clay shale. Typically, the surface layer is grayish brown clay loam about 4 inches thick. The subsoil is grayish brown and light olive brown clay to a depth of about 22 inches. It is calcareous in the lower part. The substratum is grayish brown clay to a depth of about 30 inches. Below that is gray and olive shale.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium to rapid, and the hazard of erosion is moderate. Some gullying has taken place in narrow drainageways.

These soils are used mainly for grazing. They have poor potential for cropland and for windbreaks and environmental plantings. The Cushman soil has fair to poor potential for most engineering uses, and the Kutch soil has poor potential.

Rangeland vegetation on the Cushman soil is mainly blue grama, needlegrasses, prairie junegrass, sideoats grama, and western wheatgrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

Rangeland vegetation on the Kutch soil consists of western wheatgrass, blue grama, green needlegrass, sideoats grama, and sedge. Contour furrowing or pitting aids in the recovery of depleted vegetation on this soil by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control.

These soils are generally not suited to windbreaks or environmental plantings. Onsite investigation is needed to determine which special planting practices are needed to insure survival.

The main limiting soil features of these soils, where they are used for homesites or other urban uses, are the presence of sandstone and shale at a depth of 20 to 40 inches, shrink-swell potential, slow permeability, and steep slopes. Intensive and costly measures are needed to offset these limitations.

This complex is in capability subclass VIe, nonirrigated.

17—Elbeth sandy loam, 4 to 8 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on upland hills and ridges. It formed in material transported from arkosic deposits. Elevation ranges from 6,400 to 7,300 feet. Average annual precipitation is about 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Brussett loam, Peyton sandy loam, and Pring coarse sandy loam that have 4 to 8 percent slopes and Kettle loamy sand, 8 to 15 percent slopes.

Typically, the surface layer is dark gray and light gray sandy loam and loamy sand about 8 inches thick. The subsoil to a depth of about 60 inches is yellowish brown to very pale brown sandy clay loam and sandy loam.

Permeability is moderate, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used for woodland, grazing, recreation, wildlife habitat, and homesites. It has poor potential for cropland. A few areas were once cultivated, but most have been reseeded to grass or have been invaded by ponderosa pine. This soil has good to fair potential for most engineering uses.

The Elbeth soil is suited to production of ponderosa pine. It is capable of producing 1,840 cubic feet of wood per acre or 5,680 board feet (International rule) of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

The main limiting soil feature for homesites is the moderate shrink-swell potential of the subsoil. Special designs are needed to overcome this limitation.

This soil is in capability subclass IVe, nonirrigated.

18—Elbeth-Kettle complex, 8 to 25 percent slopes. These deep, well drained, moderately sloping to moderately steep soils are on fans, bench edges, hills, and ridges. Elevation ranges from about 6,400 to 7,300 feet. Average annual precipitation is about 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days. The Elbeth soil makes up about 50 percent of the unit and the Kettle soil about 25 percent. The Elbeth soil is on ridgetops and moderately sloping to strongly sloping hillsides. The Kettle soil is on fans, slope breaks of benches, and moderately steep hill sides.

Included with this complex in mapping, and making up about 25 percent of the unit, are Peyton-Pring complex, 8 to 25 percent slopes; Haplustolls, loamy, nearly level; gravelly knobs; and rock outcrop.

The Elbeth soil formed in material transported from arkosic deposits. Typically, the surface layer is dark gray and light gray sandy loam and loamy sand about 8 inches thick. The subsoil to a depth of about 60 inches is yellowish brown to very pale brown sandy clay loam and sandy loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate to high.

The Kettle soil formed in arkosic sandy alluvium. Typically, the surface layer is gray and light gray loamy sand about 22 inches thick. The subsoil is light brownish gray coarse sandy loam to a depth of about 53 inches. It has a matrix of loamy coarse sand in which thin bands of sandy clay loam or heavy sandy loam are embedded. The substratum is very pale brown coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have formed in the drainageways (fig. 6).

These soils are used for woodland, grazing, recreation, wildlife habitat, and homesites. They have poor potential for cropland and fair to poor potential for most engineering uses.

The Elbeth soil is suited to the production of ponderosa pine. It is capable of producing 1,840 cubic feet of wood per acre, or 5,680 board feet (International rule), of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

The Kettle soil is suited to the production of ponderosa pine (fig. 7). It is capable of producing 2,820 cubic feet of wood per acre or 10,040 board feet (International rule) of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

Where these soils are used for homesites or other urban purposes, the limiting soil features are the shrink-swell potential of the Elbeth soil and the steep slopes of both the Elbeth soil and the Kettle soil. Special designs are necessary to compensate for these limiting soil features. Special erosion control practices are needed to minimize surface runoff in order to minimize the hazard of erosion.

This complex is in capability subclass VIe, nonirrigated.

19—Ellicott loamy coarse sand, 0 to 4 percent slopes. This deep, somewhat excessively drained, nearly level to gently sloping soil is on terraces and flood plains. It formed in noncalcareous arkosic sandy alluvium throughout most of the survey area. Elevation ranges from about 5,300 to 6,800 feet. Average annual precipitation ranges from 14 to 19 inches, and average annual air temperature is about 47 degrees F.

Included with this soil in mapping are small areas of Fluvaquents, nearly level; Haplustolls, loamy; Haplustolls, moderately coarse, nearly level; and riverwash.

Typically, the surface layer is light gray loamy coarse sand and gray loamy sand about 14 inches thick. The substratum is light brownish gray and light gray loamy sand and loamy coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is high.

This soil is used for grazing. It has poor potential for cropland, windbreaks and environmental plantings, and engineering uses.

Rangeland vegetation consists of switchgrass, sand dropseed, sand reedgrass, and sand bluestem. Willows and cottonwood trees are common in low areas. This soil is subject to flooding and needs to maintain a dense cover of grass in order to be protected from wind and water erosion.

Windbreaks and environmental plantings are difficult to establish on this soil. Wind erosion and low available water capacity are the main limitations to establishing trees and shrubs. Trees need to be planted in shallow furrows, and vegetative cover needs to be maintained between the rows. Supplemental irrigation is needed to insure survival. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and Siberian elm. The best suited shrubs include skunkbush sumac.

Potential for homesites and other urban uses is severely limited because of the flood hazard.

This soil is in capability subclass VIIw, nonirrigated.

20—Englewood clay loam, 0 to 4 percent slopes. This deep, well drained, nearly level to gently sloping soil is on alluvial fans and valley side slopes. It formed in clayey alluvium weathered from sedimentary bedrock. Elevation ranges from about 6,000 to 6,800 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 130 days.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 4 percent slopes, and Haplustolls, loamy, nearly level.

Typically, the surface layer is gray and grayish brown clay loam about 4 inches thick. The subsoil is gray and dark gray clay loam and clay to a depth of about 40 inches. The substratum is light gray clay loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for grazing. Small areas are used for nonirrigated cropland with wheat as the main crop. The estimated yield for wheat is about 25 bushels per acre. This soil has good potential for windbreaks and environmental plantings. It has fair potential for most engineering uses.

Rangeland vegetation is mainly western wheatgrass, blue grama, bluegrass, green needlegrass, sideoats grama, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control.

In nonirrigated cropland areas, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are needed to protect against wind erosion and to improve water and root penetration. Chiseling and subsoiling also improve water and root penetration. Tillage pans form easily if this soil is tilled when wet.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Where this soil is used for homesites and other urban uses, the main limiting soil properties are slow permeability, high shrink-swell, and low strength. Special designs and intensive engineering measures are needed to minimize these limitations.

This soil is in capability subclass IIIe, nonirrigated.

21—Fluvaquents, nearly level. These deep, poorly drained soils are on swales and on creek bottoms along most of the major drainageways and in localized marshes. They formed in mixed, recent alluvium. Slopes are 0 to 4 percent.

These soils are extremely stratified and variable in texture, ranging from clay loam to gravelly sand to a depth of 60 inches or more.

These soils have a water table that is less than 30 inches from the surface most of the year. They are subject to annual flooding during spring and summer.

These soils are mainly used for rangeland and wildlife habitat. Small localized areas that are better drained are used for hayland (fig. 8).

Native vegetation consists mainly of prairie sandreed, switchgrass, western wheatgrass, and sand bluestem. In places cottonwood trees, willows, and shrubs are present. When range condition deteriorates, the tall and mid grasses decrease, production drops, and sedge and rush increase. Cattails are present in marsh areas. Potential vegetation is variable from place to place, but generally ranges from about 3,000 pounds per acre in favorable years to 1,800 pounds per acre in unfavorable years.

Wetland wildlife, especially waterfowl, use these soils. The high water table allows production of wetland plants that provide nesting and protective cover, as well as some food for waterfowl. These soils also provide excellent cover for deer. Management for wildlife should include prevention of overgrazing by livestock and protection against accidental fires. Where livestock is present, wildlife areas need to be fenced to prevent overuse.

Annual flooding and a high water table limit the use of these soils for homesites or other urban uses.

These soils are in capability subclass VIw.

22—Haplustolls, moderately coarse, nearly level. These deep, well drained soils are on stream terraces and flood plains along drainageways throughout the survey area. Some of the larger areas of these soils are in the Kiowa, Comanche, East Bijou, West Bijou, and Big Sandy Creeks. These soils formed in moderately coarse textured and coarse textured noncalcareous alluvium. Slopes are 0 to 4 percent.

Included with these soils in mapping are small areas of Bresser sandy loam, 0 to 4 percent slopes; Ellicott loamy coarse sand, 0 to 4 percent slopes; and Haplustolls, loamy, nearly level. In some localized areas, recent flooding has left a 1- to 5-inch layer on the surface that is light colored material ranging from sandy loam to loamy sand.

The soils in this map unit are dark and range from 7 to 40 inches thick. Stratification is common in the surface layer and the underlying layers. Texture is variable but generally is sandy loam. About 20 percent of these soils is loamy coarse sand.

Permeability is moderately rapid, and available water capacity is moderate to low. The effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate to high. These soils are subject to occasional flooding.

These soils are used mainly for rangeland. Some large areas are used for nonirrigated cropland. Common crops are alfalfa and small grain.

Conserving moisture and protecting the soil from erosion are the main concerns of management on nonirrigated cropland. Summer fallow is necessary because of insufficient precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect the soil from blowing, improve soil tilth, and conserve moisture. Tillage operations need to be kept to a minimum.

Rangeland vegetation is mainly switchgrass, blue grama, Indiangrass, western wheatgrass, and big bluestem. In some areas, scattered willows and cottonwoods are present (fig. 9). Potential production ranges from 2,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years.

Windbreaks and environmental plantings are difficult to establish on the soils in this unit. Wind erosion and low available water capacity are the main limitations to the establishment of trees and shrubs. Trees need to be planted in shallow furrows and vegetative cover maintained between the rows. Supplemental irrigation is needed to insure survival.

The use of these soils for homesites and other urban uses is limited by the flood hazard.

These soils are in capability subclass IVw, nonirrigated.

23—Haplustolls, loamy, nearly level. These deep, well drained loamy soils are on stream terraces and fans along creek drainageways. They are throughout the survey area. Some of the larger areas of these soils are in the Kiowa, Commanche, East Bijou, West Bijou, and Big Sandy Creeks. They formed in loamy textured alluvium. In most areas they are noncalcareous.

Included with these soils in mapping are small areas of Bresser sandy loam, 0 to 4 percent slopes; Nunn clay loam, 0 to 4 percent slopes; and Haplustolls, moderately coarse, nearly level.

The soils in this map unit are dark and range from 10 to 35 inches thick. Stratification is common in the surface layer and the underlying layers. Texture is variable but ranges from loam to clay loam.

Permeability is moderate to moderately slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. This soil is subject to rare flooding.

These soils are mainly used for grazing, but some areas are used for nonirrigated and sprinkler irrigated cropland. Alfalfa, small grains, forage sorghums, corn, and beans are grown on these soils (fig. 10).

Conserving moisture and protecting the soil from erosion are the main concerns of management on nonirrigated cropland. Summer fallow is necessary because of insufficient precipitation. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect the soil from blowing, improve water infiltration, improve soil tilth, and conserve moisture. Tillage operations need to be kept to a minimum.

Where these soils are sprinkler irrigated, incorporating crop residue into the soil and maintaining organic matter content increase water infiltration and improve soil tilth. Applications of manure and commercial fertilizer that contain nitrogen and phosphorus are needed to maintain fertility.

Rangeland vegetation is mainly blue grama, western wheatgrass, needlegrasses, prairie junegrass, and sideoats grama. Potential production ranges from 2,000 pounds in favorable years to 800 pounds in unfavorable years.

These soils are well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings.

These soils are suited to openland wildlife, such as cottontail and mourning dove. In cropland areas, favorable habitat can be developed by establishing nesting and escape cover. Rangeland wildlife, such as antelope and deer, can be increased by establishing good livestock water developments. Trees and shrubs along drainageways offer shelter and feed to wildlife.

The main limitation to use of these soils as homesites and other urban uses is the flooding hazard. Levees, dikes, and diversions can be used to help offset this limitation.

These soils are in capability subclass IIw, irrigated and IIIw, nonirrigated.

24—Heldt clay loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, well drained soil is on alluvial fans and terraces. It formed in clayey alluvium derived from shale and is mainly along the West Bijou Creek drainageway. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 140 days.

Included with this soil in mapping are small areas of Englewood clay loam and Nunn clay loam that have 0 to 4 percent slopes.

Typically, the surface layer is light brownish gray clay loam about 2 inches thick. The subsoil is grayish brown clay to a depth of about 22 inches. The substratum is light brownish gray clay loam and clay to a depth of 65 inches.

Permeability is slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for grazing. A few small areas are used for nonirrigated cropland. Alfalfa and wheat are the main crops. This soil is poorly suited to windbreaks and environmental plantings. It has poor suitability for most engineering uses.

Rangeland vegetation is mainly western wheatgrass, Indian ricegrass, blue grama, green needlegrass, bluegrass, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation on this soil by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

In nonirrigated cropland areas, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are needed to minimize surface wind erosion, to improve soil tilth, and to conserve moisture. Chiseling and subsoiling improve water and root penetration. Tillage pans form easily if this soil is tilled when wet.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

The main limiting soil features, where this soil is used for homesites, are slow permeability, high shrink-swell potential, and low strength. Special site or building designs are necessary to offset these limiting soil features. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IVs, nonirrigated.

25—Holderness loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, well drained soil is on upland terraces and alluvial fans (fig. 11). It formed in alluvium derived from arkosic sedimentary rock. Elevation ranges from about 6,800 to 7,300 feet. Average annual precipitation ranges from 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Brussett loam, 0 to 4 percent slopes; Peyton sandy loam, 4 to 8 percent slopes; and Coni loam, 4 to 15 percent slopes.

Typically, the surface layer is dark grayish brown loam about 4 inches thick. The subsoil is grayish brown, light brownish gray, and light gray clay loam to a depth of 38 inches. The substratum is light gray sandy clay loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used equally for nonirrigated cropland and grazing. Wheat is the main crop grown along with some smaller acreages of oats and rye. The estimated yield for wheat is about 20 bushels per acre, and it is 25 bushels per acre for oats. The choice of crops is limited because of the short growing season. This soil has good potential for windbreaks and environmental plantings.

Rangeland vegetation is mainly mountain muhly, western wheatgrass, and Parry oatgrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheat, mountain brome, and Arizona fescue, are recommended for range seeding.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Where this soil is used for homesites and other urban developments, the main limiting soil properties are high shrink-swell potential, low strength, and slow permeability. Special designs are needed to minimize these limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IIIe, nonirrigated.

26—Holderness loam, 4 to 8 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on upland terraces and alluvial fans. It formed in alluvium derived from arkosic sedimentary rock. Elevation ranges from about 6,800 to 7,300 feet. Average annual precipitation ranges from 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Brussett loam, 4 to 8 percent slopes; Coni loam, 4 to 15 percent slopes; and Peyton sandy loam, 4 to 8 percent slopes.

Typically, the surface layer is dark grayish brown loam about 4 inches thick. The subsoil is grayish brown, light brownish gray, and light gray clay loam to a depth of about 38 inches. The substratum is light gray sandy clay loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

Most of this soil is used for grazing. A few areas of this soil have previously been used for nonirrigated cropland, but most of them have been seeded back to grass.

Rangeland vegetation is mainly mountain muhly, Arizona fescue, and Parry oatgrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, mountain brome, and Arizona fescue, are recommended for range seeding.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Where this soil is used for homesites and other urban uses, the main limiting soil properties are high shrink-swell potential, low strength, and slow permeability. Special designs are needed to minimize these limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IVe, nonirrigated.

27—Kettle loamy sand, 8 to 15 percent slopes. This deep, well drained, strongly sloping soil is on upland fans, hills, and bench edges (fig. 12). It formed in arkosic sandy alluvium. Elevation ranges from about 6,400 to 7,300 feet. Average annual precipitation ranges from about 17 to 19 inches, average annual temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Elbeth sandy loam, 4 to 8 percent slopes.

Typically, the surface layer is gray and light gray loamy sand about 22 inches thick. The subsoil is light brownish gray coarse sandy loam to a depth of about 53 inches. It has a matrix of loamy coarse sand in which thin bands of sandy clay loam or heavy sandy loam are embedded. The substratum is very pale brown coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used mainly for woodland. It is also used for grazing, homesites, and wildlife habitat.

The Kettle soil is suited to the production of ponderosa pine. It is capable of producing 2,820 cubic feet of wood per acre or 10,040 board feet (International rule) of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

This soil is suited to homesites. The main limiting soil feature is slope. This limitation can be offset by using special designs for planning building sites and roads. In planning areas of this soil for homesite development, care should be taken to preserve properly spaced trees for esthetic value.

This soil is in capability subclass VIe, nonirrigated.

28—Kettle-Rock outcrop complex, 15 to 65 percent slopes. This moderately steep to very steep complex is on ridges and valley side slopes. Elevation ranges from 6,400 to 7,300 feet. Average annual precipitation ranges from about 17 to 19 inches, and average annual air temperature is about 43 degrees F. The Kettle soil makes up about 40 percent of the unit and Rock outcrop about 35 percent. The Kettle soil is generally in the lower and less sloping areas.

Included with this complex in mapping are small areas of Torriorthents-Rock outcrop, steep, and Elbeth sandy loam, 4 to 8 percent slopes.

The Kettle soil is deep and well drained. It formed in arkosic sandy alluvium. Typically, the surface layer is gray and light gray loamy sand about 22 inches thick. The subsoil is light brownish gray coarse sandy loam to a depth of about 53 inches. It has a matrix of loamy coarse sand in which thin bands of sandy clay loam or heavy sandy loam are embedded. The substratum is very pale brown coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is low to moderate. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high.

Rock outcrop is on the steeper and upper parts of slopes. In a few places it is in the form of nearly vertical cliffs. Large stones are common on the lower parts of slopes.

This complex is used mainly for woodland and wildlife habitat. Small areas are used for grazing. The trend for development of homesites has been increasing in the past few years, even though the limiting soil features are severe.

The Kettle soil is suited to the production of ponderosa pine. It is capable of producing 2,820 cubic feet of wood per acre or 10,040 board feet (International rule) of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

Where this complex is used for homesites and recreational development, the main limiting soil features are steep slopes, rock outcrop, and shallow depth to rock. Special site or building designs are needed because of the limitations. Erosion control practices are needed to minimize surface runoff, thereby keeping erosion to a minimum.

This complex is in capability subclass VIIe, nonirrigated.

29—Kutch clay loam, 0 to 4 percent slopes. This moderately steep, nearly level to gently sloping, well drained soil is on upland side slopes. It formed in fine textured calcareous material weathered from clay shale. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Cushman loam and Nunn clay loam that have 0 to 4 percent slopes.

Typically, the surface layer is grayish brown clay loam about 4 inches thick. The subsoil is grayish brown and light olive brown clay to a depth of about 22 inches. The substratum is grayish brown clay to a depth of about 30 inches. Below that is gray and olive shale.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is slow to medium, and the hazard of erosion is slight.

This soil is used for nonirrigated cropland and grazing. Wheat and forage sorghums are the main crops grown on the nonirrigated cropland. The estimated yield for wheat is about 18 bushels per acre. Several areas that were previously cropped have been seeded to grass and are used for pasture. This soil has poor potential for windbreaks and environmental plantings.

In nonirrigated cropland areas, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are needed to protect the surface soils from blowing and to improve water and root penetration. Tillage pans form easily if this soil is tilled when wet. Terracing is also beneficial for reducing runoff and conserving moisture.

Rangeland vegetation is mainly western wheatgrass, blue grama, green needlegrass, bluegrass, Indian ricegrass, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation on this soil by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

Where this soil is used for homesites or other urban uses, the main limiting soil properties are depth to rock, slow permeability, high shrink-swell potential, and low strength. Special site or building designs are needed to offset the limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IVe, nonirrigated.

30—Kutch clay loam, 4 to 8 percent slopes. This moderately deep, gently sloping and moderately sloping, well drained soil is on upland hills, ridges, and valley side slopes. It formed in fine textured calcareous material weathered from clay shale. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Nunn clay loam and Renohill clay loam that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown clay loam about 4 inches thick. The subsoil is grayish brown and light olive brown clay to a depth of about 22 inches. The substratum is grayish brown clay to a depth of about 30 inches. Below that is gray and olive shale.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have formed along drainageways.

Most of this soil is used for grazing. A few small areas are used for nonirrigated cropland, and wheat is the main crop grown. The estimated yield for wheat is about 16 bushels per acre. Many formerly cropped areas have been seeded to grass. This soil is well suited to grazing (fig. 13).

Rangeland vegetation is mainly western wheatgrass, blue grama, green needlegrass, bluegrass, Indian ricegrass, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

In nonirrigated cropland areas, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are needed to protect the surface soil from blowing, improve soil tilth, and conserve moisture. Chiseling and subsoiling improve water and root penetration. Tillage pans form easily if this soil is tilled when wet. Terracing is also beneficial for reducing runoff, controlling erosion, and conserving moisture.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

Where this soil is used for homesites or other urban purposes, the main limiting soil properties are depth to rock, slow permeability, high shrink-swell potential, and low strength. Special site or building designs are necessary to offset the limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IVe, nonirrigated.

31—Kutch-Louviers complex, 8 to 25 percent slopes. These moderately sloping to moderately steep soils are on upland hills, ridges and valley side slopes. Average annual precipitation ranges from 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Kutch soil makes up about 40 percent of the map unit and Louviers soil about 30 percent. The Kutch soil is on side slopes and wider ridgetops. The Louviers soil is generally on slope breaks, narrow ridgetops, and knobs but may be almost anywhere in the map unit.

Included with this complex in mapping, and making up about 30 percent of this unit, are Cushman-Ascalon complex, 4 to 15 percent slopes; Nunn clay loam and Renohill clay loam that have 4 to 8 percent slopes; and small outcrops of sandstone and shale. Areas of this soil are dissected by gullies and small drainageways.

The Kutch soil is moderately deep and well drained. It formed in fine textured calcareous material weathered from clay shale. Typically, the surface layer is grayish brown clay loam about 4 inches thick. The subsoil is grayish brown and light olive brown clay to a depth of about 22 inches. The substratum is grayish brown clay to a depth of about 30 inches. Below that is gray and olive shale.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate to high.

The Louviers soil is shallow and well drained. It formed in material weathered from noncalcareous shale. Typically, the surface layer is light brownish gray clay about 5 inches thick. The substratum is grayish brown clay to a depth of about 14 inches. Below that is clay shale.

Permeability is slow, and available water capacity is low. The effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is high.

Most of this complex is used for grazing. A few open clay mines are located on this unit. The soils in this unit are poorly suited to cropland, windbreaks and environmental plantings, and most engineering uses.

Rangeland vegetation on the Kutch soil is mainly western wheatgrass, Indian ricegrass, bluegrass, fourwing saltbush, blue grama, green needlegrass, and sideoats grama. On the Louviers soil the vegetation is predominantly western wheatgrass, needlegrass, blue grama, sideoats grama, little bluestem, and winterfat. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear and rabbitbrush can be managed by chemical control of these species.

These soils are generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

These soils are poorly suited to the construction of homesites, roads, and other urban developments because of depth to bedrock, slow permeability, high shrink-swell potential, slopes, and low strength.

This complex is in capability subclass VIe, nonirrigated.

32—Nunn clay loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, well drained soil is on terraces and fans. It formed in mixed clayey alluvium. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation is about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Englewood clay loam; Haplustolls, loamy, nearly level;

and Heldt clay loam. They each have 0 to 4 percent slopes.

Typically, the surface layer is grayish brown clay loam about 8 inches thick. The subsoil is grayish brown clay loam, clay, and silty clay to a depth of about 40 inches. The substratum is light brownish gray sandy loam to a depth of about 55 inches and light olive brown silty clay to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for nonirrigated cropland and grazing. A few small areas are used for irrigated cropland. Wheat and forage sorghums are the main crops on nonirrigated cropland. The estimated yield for wheat is about 20 bushels per acre. Alfalfa and corn are the main crops on irrigated cropland.

On nonirrigated cropland, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface are needed to improve water infiltration. Tillage pans form easily if this soil is tilled when wet. Chiseling or subsoiling breaks up tillage pans and improves water infiltration. Tillage operations need to be kept to a minimum. Terracing is also beneficial for reducing runoff and conserving moisture.

Management concerns on irrigated cropland are mainly proper use of irrigation water, slow permeability, and maintenance of fertility. Incorporating crop residue in the surface increases infiltration and improves soil tilth. Applications of manure and commercial fertilizers that contain nitrogen and phosphorus are needed to maintain soil productivity.

Rangeland vegetation is mainly western wheatgrass, blue grama, green needlegrass, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation on this soil by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Limiting soil features for homesites and other urban uses are slow permeability and high shrink-swell potential. Special designs for buildings and roads are needed to offset these limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of the slow permeability.

This soil is in capability subclass IIIe, nonirrigated and IIe, irrigated.

33—Nunn clay loam, 4 to 8 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on alluvial fans and toe slopes. It formed in mixed clayey alluvium. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Ascalon sandy loam and Kutch clay loam that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown clay loam about 8 inches thick. The subsoil is grayish brown heavy clay loam, clay, and silty clay to a depth of about 40 inches thick. The substratum is light brownish gray sandy loam to a depth of about 55 inches and light olive brown silty clay to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Gullies have formed along some drainageways.

This soil is used mainly for grazing. A few areas are used for nonirrigated cropland, and wheat is the main crop. The estimated yield for wheat is about 16 bushels per acre. Many areas that were previously cropped have been seeded to grass. This soil is well suited to grazing because of slow permeability and the moderate hazard of erosion.

Rangeland vegetation is mainly western wheatgrass, blue grama, green needlegrass, and fourwing saltbush. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

On nonirrigated cropland, the main concerns of management are conserving moisture and protecting the soil from erosion. Stubble mulch tillage and incorporating crop residue in and on the surface improve soil tilth and protect the soil from erosion. Terracing and contour farming are needed to reduce surface runoff and conserve water. Chiseling or subsoiling improve water penetration. Tillage pans form easily if this soil is tilled when wet. More intensive conservation practices are essential on this soil because of slope. Tillage operations need to be kept to a minimum.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

The limiting soil features for homesites and other urban uses are slow permeability and high shrink-swell potential. Special designs for buildings and roads are needed to offset these limitations. Special sewage systems, such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of the slow permeability.

This soil is in capability subclass IVe, nonirrigated.

34—Peyton sandy loam, 4 to 8 percent slopes. This deep, gently sloping to moderately sloping, well drained soil is on upland alluvial fans and valley side slopes (fig. 14). It formed in arkosic alluvium and residuum. Elevation ranges from about 6,400 to 7,300 feet. Average annual precipitation ranges from about 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Brussett loam, Holderness loam, and Elbeth sandy loam that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown sandy loam and dark grayish brown sandy clay loam about 7 inches thick. The subsoil to a depth of about 32 inches is dark grayish brown, grayish brown, and light brownish gray sandy clay loam. The substratum is light brownish gray and white coarse sandy loam and loamy coarse sand to a depth of 60 inches.

Permeability is moderate, and available water capacity is moderate to high. Surface runoff is medium, and the hazard of erosion is moderate. In a few areas, shallow gullies and rills are common.

Most of this soil is used for grazing. A few areas are used for nonirrigated cropland, and wheat is the main crop. The estimated yield for wheat is about 20 bushels per acre, and it is 27 bushels per acre for oats. The choice of crops is limited by the short growing season. This soil is well suited to windbreaks and environmental plantings and for most engineering uses.

Rangeland vegetation is mainly prairie sandreed, mountain muhly, sand bluestem, prairie junegrass, little bluestem, and blue grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses are desirable for range seeding, but tame species, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, and intermediate wheatgrass, may also be used.

The main concerns of management on nonirrigated cropland are conserving moisture and protecting the soil from wind and water erosion. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect the soil from erosion, improve soil tilth, and conserve moisture. Chiseling or subsoiling breaks up tillage pans and improves water infiltration in the subsoil. Planting crops in alternate strips at right angles to the prevailing wind is also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally needed at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

This soil is well suited to the construction of homesites and other urban developments and has only minor limitations that can be easily modified. Where this soil is used for a sewage lagoon system, special sealing methods are needed to overcome the excessive seepage condition.

This soil is in capability subclass IVe, nonirrigated.

35—Peyton-Elbeth sandy loams, 8 to 25 percent slopes. These deep, moderately sloping to moderately steep, well drained soils are on upland hills and ridges. Elevation ranges from about 6,400 to 7,300 feet. Average annual precipitation ranges from about 17 to 19 inches, and average annual air temperature is about 43 degrees F. The Peyton soil makes up about 50 percent of the unit and the Elbeth soil about 30 percent. The Peyton soil is in the open grassland areas, and the Elbeth soil is in the woodland areas.

Included with these soils in mapping, and making up about 20 percent of the unit, are Bluerim sandy loam; Kettle loamy sand, 8 to 15 percent slopes; Pring coarse sandy loam, 4 to 8 percent slopes; and a few sandstone and shale outcrops.

The Peyton soil formed in arkosic alluvium and residuum. Typically, the surface layer is grayish brown sandy loam and dark grayish brown sandy clay loam about 7 inches thick. The subsoil to a depth of about 32 inches is dark grayish brown, grayish brown, and light brownish gray sandy clay loam. The substratum is light brownish gray and white coarse sandy loam and loamy coarse sand to a depth of 60 inches.

Permeability is moderate, and available water capacity is moderate to high. Surface runoff is medium, and the hazard of erosion is moderate. Shallow gullies and rills are in a few areas.

The Elbeth soil formed in material transported from arkosic deposits. Typically, the surface layer is dark gray and light gray sandy loam and loamy sand about 8 inches thick. The subsoil to a depth of about 60 inches ranges from yellowish brown to very pale brown and is sandy clay loam and sandy loam.

Permeability is moderate, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate to high. Gullying has taken place along some drainageways.

Most of the soils in this unit are used for grazing, but other uses are for woodland and for homesite development. Small areas that had previously been cultivated have been seeded to grass.

Rangeland vegetation of the Peyton soil is mainly prairie sandreed, mountain muhly, prairie junegrass, sand bluestem, little bluestem, and blue grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses are desirable for range seeding, but tame species, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, and intermediate wheatgrass, may also be used.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

The Elbeth soil is suited to the production of ponderosa pine (fig. 15). It is capable of producing 1,840 cubic feet of wood per acre or 5,680 board feet (International rule) of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

Where these soils are used for homesites or other urban purposes, the limiting soil features are shrink-swell potential and steep slopes. Special designs are needed to compensate for these limitations. Special erosion control practices are needed to minimize surface runoff, thereby protecting the soil from erosion.

These soils are in capability subclass VIe, nonirrigated.

36—Peyton-Pring complex, 8 to 25 percent slopes. These deep, moderately sloping to moderately steep, well drained soils are on upland hills and ridges. Elevation ranges from about 6,400 to 7,300 feet. Average annual precipitation ranges from about 17 to 19 inches, and average annual air temperature is about 43 degrees F. The Peyton soil makes up about 50 percent of the unit and the Pring soil about 35 percent. The Peyton soil is along drainageways and the lower side slopes. The Pring soil is on the upper side slopes, hilltops, and ridges.

Included with this complex in mapping, and making up about 15 percent of the unit is Coni loam, 4 to 15 percent slopes.

The Peyton soil formed in arkosic alluvium and residuum. Typically, the surface layer is grayish brown sandy loam and dark grayish brown sandy clay loam about 7 inches thick. The subsoil to a depth of about 32 inches is dark grayish brown, grayish brown, and light brownish gray sandy clay loam. The substratum is light brownish gray and white coarse sandy loam and loamy coarse sand to a depth of 60 inches.

The Pring soil formed in arkosic sediment. Typically, the surface layer is dark grayish brown coarse sandy loam about 18 inches thick. The substratum is grayish brown coarse sandy loam and loamy coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate. Gullies have developed along some of the drainageways.

Most of the soils in this unit are used for grazing. A few areas are used for homesites. These soils have poor potential for cropland because of steep slopes.

Rangeland vegetation on the Peyton soils is mainly mountain muhly, western wheatgrass, sand and little bluestem, needlegrasses, prairie sandreed, and prairie junegrass. The predominant grasses on the Pring soil are Arizona fescue, mountain muhly, needlegrass, blue grama, and Parry oatgrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as western wheatgrass, mountain brome, and Arizona fescue, are recommended for range seeding.

These soils are generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally needed at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

Where these soils are used for homesites and other urban uses, the main limiting soil property is steep slopes. These soils need special site or building designs because of the slope.

This complex is in capability subclass VIe, nonirrigated.

37—Pring coarse sandy loam, 4 to 8 percent slopes. This deep, well drained soil is on upland alluvial fans, hills, ridges, and side slopes. It formed in arkosic sediment. Elevation ranges from 6,400 to 7,300 feet. Average annual precipitation ranges from 17 to 19 inches, average annual air temperature is about 43 degrees F, and average frost-free period is about 120 days.

Included with this soil in mapping are small areas of Elbeth sandy loam and Peyton sandy loam that have 4 to 8 percent slopes.

Typically, the surface layer is dark grayish brown coarse sandy loam about 18 inches thick. The substratum is grayish brown coarse sandy loam and loamy coarse sand to a depth of 60 inches.

Permeability is rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used mostly for grazing. A few small areas are used for nonirrigated cropland. Wheat is the main crop grown. The choice of crops is limited because of the short growing season. This soil is well suited to windbreaks and environmental plantings and for most engineering uses.

Rangeland vegetation is mainly mountain muhly, Arizona fescue, needlegrasses, bluegrasses, blue grama, and prairie junegrass. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and Kentucky bluegrass, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses are recommended for range seeding, but tame species, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

Conserving moisture and protecting the soil from erosion are the main concerns of management. Summer fallow is necessary because of insufficient moisture. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to protect the soil from erosion, improve soil tilth, and conserve moisture. Terracing also helps in stabilizing the soil and holding moisture. Stripcropping at right angles to the prevailing wind is also effective in protecting the soil from blowing. Tillage operations need to be kept to a minimum. Intensive use of these practices is essential for protecting this soil and maintaining its productivity.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally necessary at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

This soil is well suited to homesites and other urban uses and has only minor limitations that can be easily overcome.

This soil is in capability subclass IVe, nonirrigated.

38—Renohill clay loam, 4 to 8 percent slopes. This moderately deep, gently sloping and moderately sloping, well drained soil is on hills and ridges. It formed in residuum weathered from interbedded sandstone and shale. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Cushman sandy loam and Wiley-Baca loams that have 4 to 8 percent slopes.

Typically, the surface layer is grayish brown clay loam about 2 inches thick. The subsoil is grayish brown, light olive brown, and light yellowish brown clay and clay loam. It is calcareous in the lower part. Below that is interbedded sandstone and clay shale at a depth of about 24 inches.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for grazing. A few small areas are used for nonirrigated cropland, and the main crop is wheat. This soil is suited to windbreaks and environmental plantings.

Rangeland vegetation is mainly western wheatgrass, blue grama, and prairie junegrass. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation on this soil by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

On nonirrigated cropland, management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are needed to protect the surface soil from blowing and improve water and root penetration. Tillage pans form easily if this soil is tilled when wet. Terracing is also beneficial for reducing runoff and conserving moisture.

This soil is generally not suited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

Where this soil is used for homesites or other urban uses, the main limiting soil properties are depth to rock, slow permeability, high shrink-swell potential, and low strength. Special site or building designs are needed to minimize these limitations. Special sewage systems such as enclosed tanks that can be pumped out periodically, are needed. Septic tank absorption fields will not function properly because of slow permeability.

This soil is in capability subclass IVe, nonirrigated.

39—Renohill-Louviers complex, 8 to 25 percent slopes. These moderately deep and shallow, moderately sloping to moderately steep, well drained soils are on upland hills, ridges, and valley side slopes. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Renohill soil makes up about 40 percent of the unit and the Louviers soil about 30 percent. The Renohill soil is on the valley side slopes and the wider ridgetops. The Louviers soil is generally on the narrow ridgetops, slope breaks, and knobs but may be found anywhere in the mapped area.

Included with this complex in mapping, and making up about 30 percent of the unit are Cushman loam and Nunn clay loam that have 4 to 8 percent slopes. Also included are steep, badly eroded areas that have very sparse vegetation and contain an intricate maze of narrow ravines, sharp crests, and pinnacles.

The Renohill soil is moderately deep and formed in residuum weathered from interbedded sandstone and shale. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The subsoil is grayish brown, light olive brown, and light yellowish brown clay and clay loam. It is calcareous in the lower part. Below that is interbedded sandstone and clay shale at a depth of about 24 inches.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is high.

The Louviers soil is shallow and formed in material weathered from noncalcareous shale. Typically, the surface layer is light brownish gray clay about 5 inches thick. The substratum is grayish brown clay to a depth of about 14 inches. Below that is clay shale.

Permeability is slow, and available water capacity is low. The effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is high.

These soils are used mostly for grazing. A few open clay mines are in this mapped area.

Rangeland vegetation is mainly western wheatgrass, little bluestem, needleandthread, blue grama, green needlegrass winterfat, and sideoats grama. Following prolonged overgrazing, native bluegrasses, annual grasses, and weeds increase. Contour furrowing or pitting aids in the recovery of depleted vegetation on these soils by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

These soils are generally unsuited to windbreaks or environmental plantings. Onsite investigation is generally needed to determine which special planting practices are needed to insure survival.

These soils have severe limitations for the construction of homesites, roads, and other urban developments because of the depth to bedrock, slow permeability, high shrink-swell potential, low strength, and slopes. Intensive and costly measures are needed to minimize these limiting soil properties.

This complex is in capability subclass VIIe, nonirrigated.

40—Torriorthents-Rock outcrop complex, steep. This complex consists of moderately steep to very steep soils on hills and ridges. Areas of this complex are long and narrow. Slopes are 15 to 65 percent. Torriorthents make up about 50 percent of the unit and Rock outcrop about 20 percent. Rock outcrop consists mostly of shale, but some sandstone outcrops are also present (fig. 16).

Included with this complex in mapping are small areas of Truckton sandy loam and Cushman loam that have 4 to 8 percent or more slopes.

The Torriorthents are shallow soils that have little or no development. Permeability is slow, and available water capacity is low. The effective rooting depth is less than 20 inches. Surface runoff is rapid, and erosion hazard is high. The absence of vegetative cover often results in deep, narrow, vertical-sided gullies.

Areas of this map unit are used entirely for grazing and wildlife habitat.

Rangeland vegetation is mainly prairie sandreed, blue grama, needleandthread, and sideoats grama. Some ponderosa pine and juniper trees and shrubs, such as mountain mahogany and skunkbush, also are present (fig. 17).

Grazing management practices that are needed to maintain and improve production and range condition are deferred grazing and proper grazing use. Fencing and livestock water development are effective in obtaining a more uniform distribution of grazing. Excessive trailing by livestock is one cause of gully erosion in this mapped area.

Mule deer and antelope use these areas for cover and food. Management of these areas for wildlife needs to include proper grazing management to prevent overgrazing.

When areas of this complex are considered for windbreak plantings and homesites, special onsite investigations are needed to select specific sites and to determine management.

This complex is in capability subclass VIIe, nonirrigated.

41—Truckton sandy loam, 4 to 8 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on upland hills, terraces, and valley side slopes. It formed in alluvium and residuum weathered from arkosic sedimentary rock. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 135 days.

Included with this soil in mapping are small areas of Bresser sandy loam, 4 to 8 percent slopes; Haplustolls, loamy, nearly level; and Truckton sandy loam, 0 to 4 percent slopes.

Typically, the surface layer is brown sandy loam about 3 inches thick. The subsoil is dark grayish brown, brown, and yellowish brown sandy loam and coarse sandy loam to a depth of about 20 inches. The substratum is very pale brown loamy coarse sand to a depth of 60 inches.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for grazing, but some areas are used for nonirrigated cropland. Wheat is the main crop. The estimated yield for wheat is about 16 bushels per acre. This soil has good potential for windbreaks and environmental plantings and for most engineering uses.

Rangeland vegetation is mainly blue grama, prairie sandreed, needleandthread, sand dropseed, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase. Sleepygrass and annuals replace these grasses if the range becomes seriously deteriorated.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

This soil is generally suited to windbreaks and environmental plantings. Wind erosion is the main limitation to the establishment of trees and shrubs. This hazard can be overcome by cultivating only in the tree row and leaving a strip of vegetative cover between the rows. Supplemental irrigation is generally needed at the time of planting and during dry periods. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, and Hansen rose.

This soil is well suited to homesites and other urban uses and has only minor limitations that can be easily overcome. Where this soil is used for a sewage lagoon system, special sealing methods are needed to overcome the excessive seepage condition.

This soil is in capability subclass IVe, nonirrigated.

42—Truckton-Renohill complex, 8 to 25 percent slopes. These moderately sloping and strongly sloping soils are on valley side slopes and ridges where a mantle of sandy material overlies interbedded shale and sandstone. Depth of the sandy material is variable. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, and average annual air temperature is about 47 degrees F. The Truckton soil makes up about 45 percent of the unit and the Renohill soil about 25 percent.

Included with this complex in mapping, and making up about 30 percent of the unit, are Cushman-Kutch complex, 8 to 25 percent slopes, and Wiley loam on ridgetops.

The Truckton soil is deep and well drained. It formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is brown sandy loam about 3 inches thick. The subsoil is dark grayish brown, brown, and yellowish brown sandy loam and coarse sandy loam to a depth of about 20 inches. The substratum is very pale brown loamy coarse sand to a depth of 60 inches.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate to high. Gullying has taken place in some of the narrow drainageways.

The Renohill soil is moderately deep and well drained. It formed in residuum weathered from interbedded shale and sandstone. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The substratum is grayish brown, light olive brown, and light yellowish brown clay and clay loam. It is calcareous in the lower part. Below that is interbedded shale and sandstone at a depth of about 24 inches.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is high. Gullying has taken place along some drainageways and livestock trails.

These soils are used entirely for grazing. They are poorly suited to cropland.

Rangeland vegetation on the Truckton soil is mainly blue grama, prairie sandreed, needleandthread, sand dropseed, and sideoats grama. When range condition deteriorates because of overgrazing or other uses, grasses, such as blue grama and native bluegrasses, and forbs, such as hairy goldaster, increase.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Native grasses, such as big bluestem, little bluestem, sideoats grama, and prairie sandreed, are recommended for range seeding. Tame grasses, such as crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass, may also be used.

The rangeland vegetation on the Renohill soil is mainly western wheatgrass, blue grama, green needlegrass, and fourwing saltbush. Contour furrowing or pitting aids in the recovery of depleted vegetation by reducing runoff and increasing water infiltration. Areas that have dense stands of pricklypear or rabbitbrush can be managed by chemical control of these species.

These soils are generally not suited to windbreaks and environmental plantings, because of the high erosion hazard and the depth to bedrock on the Renohill soil.

The main limiting soil property of the Truckton soil for homesites and other urban developments is slope. Slow permeability, high shrink-swell potential, low strength, and slope are the main limiting soil properties of the Renohill soil. Special designs are necessary to minimize these limiting soil properties.

This complex is in capability subclass VIe, nonirrigated.

43—Weld loam, 0 to 4 percent slopes. This deep, nearly level to gently sloping, well drained soil is on upland tableland. It formed in silty eolian material. Elevation ranges from about 5,300 to 6,400 feet. Average annual precipitation ranges from about 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 145 days.

Included with this soil in mapping are small areas of Baca-Wiley loams, Bresser sandy loam, and Englewood clay loam that have 0 to 4 percent slopes.

Typically, the surface layer is brown loam about 5 inches thick. The subsoil is brown and pale brown clay, silty clay, and silty clay loam to a depth of about 19 inches. It is calcareous in the lower part. The substratum is pale brown and light yellowish brown silty clay loam and loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used mostly for nonirrigated cropland. Some areas are used for grazing. Wheat and forage sorghum are the main crops grown in a crop fallow system because of the low precipitation. The estimated yield for wheat is about 25 bushels per acre. Some corn and alfalfa are also grown. This soil is well suited to windbreaks and environmental plantings.

On nonirrigated cropland, the main concern of management is conserving moisture. Management practices, such as stubble mulch tillage and incorporating crop residue in and on the surface, are necessary to improve water infiltration, improve soil tilth, and conserve moisture. Tillage pans form easily if this soil is tilled when wet. Chiseling or subsoiling breaks up tillage pans and improves water infiltration. Tillage operations need to be kept to a minimum. Terracing is also beneficial for reducing runoff and conserving moisture.

Rangeland vegetation is mainly western wheatgrass, blue grama, needlegrasses, sideoats grama, and prairie junegrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

High shrink-swell potential, low strength, and slow permeability are the main limiting soil properties for homesites and other urban developments. These limitations can be offset by special engineering designs and measures such as backfilling with desirable materials.

This soil is in capability subclass IIIe, nonirrigated.

44—Weld loam, 4 to 8 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on upland tableland. It formed in silty eolian material. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 47 degrees F, and average frost-free period is about 145 days.

Included with this soil in mapping are small areas of Wiley-Baca loams and Bresser sandy loam that have 4 to 8 percent slopes.

Typically, the surface layer is brown loam about 5 inches thick. The subsoil is brown and pale brown clay, silty clay, and silty clay loam to a depth of about 19 inches. It is calcareous in the lower part. The substratum is pale brown and light yellowish brown silty clay loam and loam to a depth of 60 inches.

Permeability is slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for grazing. A few areas are used for nonirrigated cropland and cropped mostly to wheat and forage sorghums. The estimated yield for wheat is about 20 bushels per acre. Many previously cultivated areas have been seeded to grass.

Rangeland vegetation is mainly western wheatgrass, blue grama, needlegrasses, sideoats grama, and prairie junegrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

On nonirrigated cropland, management is needed to control soil erosion, conserve moisture, and maintain productivity. Stubble mulch tillage and incorporating crop residue in and on the surface are necessary to reduce runoff and erosion and to conserve moisture. Chiseling or subsoiling is effective in breaking up tillage pans and improving water penetration. Tillage operations need to be kept to a minimum.

This soil is well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

High shrink-swell potential, low strength, and slow permeability are the limiting soil properties for homesites and other urban developments. These limitations can be modified by special engineering designs and measures such as backfilling with desirable materials.

This soil is in capability subclass IVe, nonirrigated.

45—Wiley-Baca loams, 4 to 8 percent slopes. These deep, gently sloping to moderately sloping, well drained soils are on upland side slopes. Elevation ranges from 5,300 to 6,400 feet. Average annual precipitation ranges from 14 to 17 inches, average annual air temperature is about 45 degrees F, and average frost-free period is about 145 days. The Wiley soil makes up about 45 percent of the unit and the Baca soil about 35 percent.

Included with these soils in mapping are small areas of Ascalon sandy loam, Weld loam, and Renohill clay loam that have 4 to 8 percent slopes.

The Wiley soil formed in calcareous silty eolian material. Typically, the surface layer is brown loam about 3 inches thick. The subsoil is very pale brown silty clay loam to a depth of about 29 inches. The substratum is very pale brown silt loam to a depth of 60 inches.

Permeability is moderate, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

The Baca soil formed in calcareous eolian material. Typically, the surface layer is pale brown loam about 4 inches thick. The subsoil to a depth of about 27 inches is yellowish brown and pale brown clay loam. It is calcareous in the lower part. The substratum is very pale brown silt loam to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

Most of these soils are used for grazing. Small areas are used for nonirrigated cropland, but much of the cultivated area has been seeded to grass. The estimated yield for wheat is about 15 bushels per acre.

Rangeland vegetation is mainly western wheatgrass, blue grama, needlegrasses, sideoats grama, and prairie junegrass. When range condition deteriorates, grasses such as blue grama and native bluegrasses increase. Sleepygrass and annuals replace these grasses in a seriously deteriorated range.

Seeding the range is recommended to revegetate depleted areas in order to protect the soil from wind and water erosion. Seeding to native grasses is desirable, but the range may also be seeded with tame species of grasses, such as Nordan crested wheatgrass, Russian wildrye, pubescent wheatgrass, or intermediate wheatgrass.

These soils are well suited to windbreaks and environmental plantings. Summer fallow, a year prior to planting; supplemental irrigation during planting and early stages of growth; and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Well suited trees that survive best are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The best suited shrubs are skunkbush sumac, American plum, lilac, and Siberian peashrub.

Moderate shrink-swell potential, moderately slow permeability, and low strength are the main limiting soil properties for homesites and other urban developments. These limitations can be offset by special engineering designs.

These soils are in capability subclass IVe, nonirrigated.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

John A. Knapp, district conservationist, Soil Conservation Service, assisted in preparing this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

The low average annual precipitation, ranging from 14 to 19 inches, is a major limitation to increasing productivity of nonirrigated cropland and pastureland in Elbert County. In the Elizabeth and Elbert area, the short growing season, about 110 to 125 days, further limits the choice of crops in Elbert County.

On the nonirrigated lands, wheat and pasture plants are the main crops. Approximately 75,000 acres is cropland in the survey area. There is a significant amount of barley, small acreages of corn for ensilage, and sorghum grown in the survey area. Both wind and water erosion are concerns in the cultivated areas.

Soil loss through erosion is damaging for three reasons. First, soil productivity is reduced as the surface layer with its organic matter is lost and part of the subsoil is incorporated into the tillage layer. Second, loss of the subsoil reduces the water holding capacity. Continued loss of the clay fraction from the subsoil reduces the clod forming ability and makes the soil increasingly more susceptible to erosion. Third, soil erosion results in damage to crops and land by deposition or sedimentation. It may be a hazard to the health of the biological population of the area, including man.

Measures for minimizing soil erosion in the survey area are cropping only those soils best suited for cultivation, growing crops that produce large amounts of residue, keeping crop residue intact on the surface through management of tillage and grazing after harvest, and maintaining surface roughness through proper tillage methods during periods when crop residue is inadequate.

Other conservation measures, such as the use of terraces, are applicable to the terrain and erosion characteristics of the survey area. Terraces reduce the length of slope and reduce runoff and erosion. They are practical on deep soils that have regular slopes. Most terraces in the survey area have been applied on slopes of 2 to 6 percent. Terraces need to be properly designed and supported by contour farming and crop residue management. Information concerning the design of cropping systems and erosion control practices for each kind of soil is contained in the technical guide available in the local office of the Soil Conservation Service.

Erosion control dams are being used in the survey area on and around cropland and pastureland. These structures are built in the upper parts of watersheds to collect storm runoff and to minimize the erosive force of moisture while collecting sediment misplaced from the above acreage.

Smooth bromegrass, intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, and alfalfa are the main plants used for nonirrigated pasture. They are adapted to a wide range of soils and are found throughout the survey area. Proper grazing management helps to maintain high vigor and forage production. It is the most important conservation practice for this land use.

Less than 4,000 acres of pasture and cropland in the survey area is irrigated. These areas are found mainly along the Kiowa, Comanche, Bijou, and Running Creek basins. Some surface water rights are established, but the largest amount of irrigation water comes from wells. The potential for expansion of irrigation in the area is not appreciable because of the scarcity of water and the restrictions placed on its use.

The major conservation concern with irrigation is proper water management. Generally, the irrigated soils are sandy loam in texture, with the exception of the soils in the Bijou Basin which are largely clay loam. The sandier soils have a higher rate of infiltration. Sprinkler irrigation is the main method used in the survey area. It results in satisfactory irrigation efficiency when timing and rate of application is properly adjusted to crop needs and soil type. Guidance in irrigation water management and in developing irrigation systems can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service.

All crops and pasture mixes on irrigated soils respond to fertilization. Sandy loam and loamy sand soils under sprinkler irrigation require timely and fairly heavy applications of nitrogen for all crops except alfalfa.

Irrigated cropping systems need to include a deep rooted crop, such as alfalfa, for improvement of soil tilth, addition of organic matter and nitrogen to the soil, and full utilization of fertilizers and water applied and stored in the soil under previous crops. With proper management, adequate crop residue or cover crops can be maintained to effectively control wind erosion, even on the sandy irrigated soils.

Yields per acre

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

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

Crops other than those shown in the map units are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*7*). These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Rangeland

Edward C. Dennis, range conservationist, Soil Conservation Service, assisted in preparing this section.

About 64 percent of the western part of Elbert County is rangeland. Woodland, about 8 percent of the area, and nonirrigated pasture, about 3 percent of the area, are grazed in conjunction with the grazing on rangeland. Cow-calf-steer operations are a common practice. The woodland area consists mainly of small housing tracts. Saddle horses are run on the woodland and rangeland areas. Some of these areas are severely overgrazed. The average ranch is about 2,500 acres. About one-third of the rangeland is owned by several large operators. The typical unit has some rangeland and dry farmland.

The forage produced on ranching units is supplemented by small grain crop stubble and nonirrigated pasture. In the winter the native forage is supplemented with hay and protein concentrate.

The native vegetation in most of the area is greatly depleted by continued excessive use. Much of the area, once covered with mountain muhly, western wheatgrass, big bluestem, and little bluestem, is reduced to blue grama, hairy goldaster, and fringed sage. The sandy range sites that once supported tall, deep-rooted grasses have been replaced by short grasses that have shallow root systems and low growing shrubby plants such as rabbitbrush.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed are not used for or cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. Following are explanations of column headings in table 5.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. 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 are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. 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 maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the western part of Elbert County, the amount of forage produced is about half of the potential plant community. Productivity can be increased by using management practices that are effective for the specific kinds of soils that make up a range site.

Proper grazing is the major management concern of rangeland conservation. It requires the control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished and maintained. To achieve this, 50 percent of the season's growth should be deferred until the end of the grazing period.

Deferment of grazing favors the improvement or maintenance of the condition of a range site. It is the postponement of grazing key forage plants during the main part of the growing season. When this practice is worked into planned grazing systems on a recurring basis, key forage plants have the opportunity to produce more seed.

Fencing, properly located watering areas, and salt block distribution are important management practices that help to obtain more uniform distribution of grazing.

Rangeland furrowing, chiseling, or pitting are mechanical land treatments designed to capture runoff water, improve water intake, prevent erosion, and speed recovery of vegetation.

Range seeding may be necessary to convert dry cropland to range or to improve depleted rangeland by controlling soil loss from water and wind erosion. Brush control is beneficial in areas where competitive shrubs have increased beyond the amount found in the potential vegetation.

Applying sound range management, based on soil survey information and rangeland inventories, can result in increased productivity of the rangeland.

Woodland management and productivity

Sherman Finch, woodland conservationist, Soil Conservation Service, assisted in preparing this section.

About 8 percent of the survey area is woodland (fig. 18). The main forest type is ponderosa pine, which is generally located in the Black Forest area. The cottonwood forest type is found along the stream bottoms.

Early harvests began in 1856 and extensive logging began about 1860. The lumber from the forests was used in nearby towns and for railroad ties. Because they are carefully managed, the present day forests continue to provide wood products.

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some types of forest, under proper management, can produce enough understory vegetation to support grazing of livestock or wildlife, or both.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy affects the amount of light that understory plants receive during the growing season.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing, broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

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

The suitability of a soil for windbreaks and environmental plantings and the trees and shrubs best suited are shown in the detailed map unit. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers (*5*).

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 60 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On a few of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 5 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

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

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

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

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

Wildlife habitat

Eldie W. Mustard, biologist, Soil Conservation Service, assisted in preparing this section.

Wildlife habitat diversity abounds in the survey area as evinced by conifer forests, rangeland, patches of juniper, dry cropland, and irrigated cropland along bottoms of major drainageways. This habitat diversity, affected by major land uses, allows for a variety of ecological niches which support many kinds of wildlife.

A major land use change that affects wildlife population is the recent advent of numerous residential developments, mainly in the western part of the survey area. This change from an agricultural use, often livestock grazing, to one where the rural atmosphere fosters such activities as riding horses, tends to be deleterious to wildlife population. The change of land use from agricultural to housing often destroys the things that first attracted the newcomers to the area, namely the varied wildlife and rural living.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are switchgrass, bluegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, dandilion, switchgrass, sunflower, sedges, wheatgrass, and grama.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountain-mahogany, currant, Gambel oak, skunkbush sumac, willows, snowberry, and cottonwoods.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, reed canarygrass, and saltgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bluebird, mourning dove, pheasant, meadowlark, American kestrel, cottontail rabbit, and coyote.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, great horned owl, mourning dove, Albert squirrel, mule deer, and bobcat.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, muskrat, mink, raccoon, and marsh hawk.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, prairie dog, prairie rattlesnake, kit fox, sharp-tailed grouse, golden eagle, meadowlark, western burrowing owl, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*9*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity 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 the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 14. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if disturbed. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

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

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

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

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

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Ascalon series

The Ascalon series consists of deep, well drained soils on nearly level to gently rolling uplands that formed in calcareous alluvium. Slopes are 0 to 15 percent. Mean annual precipitation ranges from about 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Ascalon soils are similar to the Bresser and Truckton soils and are near the Bresser, Cushman, Baca, and Weld soils. Bresser and Truckton soils are noncalcareous. Truckton soils have a sandy loam B horizon that contains less than 18 percent clay. Cushman soils have interbedded shale and sandstone at a depth of 20 to 40 inches. Baca and Weld soils have a B horizon that contains more than 35 percent clay.

Typical pedon of Ascalon sandy loam, 0 to 4 percent slopes, about 0.2 mile south of the northeast corner of sec. 15, T. 6 S., R. 61 W.:

A1—0 to 4 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.

B21t—4 to 7 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—7 to 13 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; thin nearly continuous clay films on faces of peds; mildly alkaline; clear wavy boundary.

B3tca—13 to 22 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; thin clay films on vertical faces of peds; visible soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C1ca—22 to 45 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium blocky structure; slightly hard, very friable; visible soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2—45 to 60 inches; yellowish brown (10YR 5/4) loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

Thickness of the solum ranges from 15 to 40 inches. Depth to calcareous material ranges from 12 to 30 inches. The content of rock fragments is 0 to 5 percent in the solum. Reaction ranges from neutral to moderately alkaline.

The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 to 4. Texture ranges from sandy clay loam to heavy sandy loam. Texture of the C horizon ranges from fine sandy loam to loamy sand.

Baca series

The Baca series consists of deep, well drained soils that formed in calcareous eolian material. Baca soils are on hilltops, benches, and toe slopes. Slopes are 0 to 8 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Baca soils are similar to Renohill soils. The Baca soils are generally near the Ascalon, Weld, and Wiley soils. The Renohill soils have shale at a depth of 20 to 40 inches. Ascalon and Weld soils have a dark surface layer, and Ascalon and Wiley soils have less than 35 percent clay in the B2t horizon.

Typical pedon of Baca loam, from an area of Baca-Wiley loams, 0 to 4 percent slopes, 2,100 feet east and 360 feet north of the southwest corner of sec. 27, T. 6 S., R. 61 W.:

A11—0 to 1 inch; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, friable; many fine and very fine roots; neutral; abrupt smooth boundary.

A12—1 to 4 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; slightly hard, friable; many fine and very fine roots; neutral; clear smooth boundary.

B1t—4 to 6 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm; thin patchy films on faces of peds; neutral; clear smooth boundary.

B21t—6 to 12 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; thin continuous clay films on faces of peds; neutral; clear smooth boundary.

B22t—12 to 18 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium and fine angular blocky; very hard, very firm; thin patchy clay films on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—18 to 27 inches; pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm; visible seams and soft masses of lime; calcareous; clear smooth boundary.

Cca—27 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; visible seams and soft masses of lime; calcareous; moderately alkaline; clear smooth boundary.

Thickness of the solum ranges from 15 to 30 inches. Depth to secondary lime ranges from 8 to 20 inches. Reaction ranges from neutral to moderately alkaline.

The A horizon has value of 5 to 7 dry and 3 or 4 moist and has chroma of 2 or 3. The B2t horizon has value of 5 to 7 dry and 4 or 5 moist and has chroma of 2 to 4. It is silty clay loam, clay loam, or clay. Texture of the C horizon ranges from silt loam to silty clay loam.

Bluerim series

The Bluerim series consists of moderately deep, well drained, moderately permeable soils on upland hills and ridges. These soils formed in residuum weathered from interbedded sandy shale and soft arkosic sandstone. Slopes are 8 to 20 percent. Mean annual precipitation ranges from about 16 to 19 inches, and mean annual air temperature is about 43 degrees F.

Bluerim soils are similar to Cushman soils, and are near the Elbeth and Peyton soils. Cushman soils have a mean annual soil temperature warmer than 47 degrees F and have a calcic horizon. Elbeth soils are deep and have an A2 horizon. Peyton soils are deep and have a mollic epipedon.

Typical pedon of Bluerim sandy loam, from an area of Bluerim-Peyton sandy loams, 8 to 20 percent slopes, about 200 feet west and 2,640 feet north of the southeast corner (north side of road) of sec. 3, T. 10 S., R. 62 W.:

A1—0 to 5 inches; light olive brown (2.5Y 5/4) sandy loam, olive brown (2.5Y 4/4) moist; moderate fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

B2t—5 to 18 inches; light olive brown (2.5YR 5/4) sandy clay loam, olive brown (2.5Y 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky, plastic; thin nearly continuous clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B3t—18 to 31 inches; light olive brown (2.5YR 5/4) sandy clay loam, light olive brown (2.5Y 5/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, slightly sticky; thin patchy clay films on faces of peds; mildly alkaline; gradual irregular boundary.

Cr—31 inches; soft, interbedded sandy shale and sandstone with a few thin seams of lime.

Thickness of the solum ranges from 15 to 31 inches. The content of rock fragments is 0 to 15 percent in the solum. Reaction is neutral or mildly alkaline.

The A1 horizon has value of 4 or 5 dry and 3 or 4 moist and has chroma of 2 to 4. The B2t horizon has value of 5 or 6 dry and 4 or 5 moist and has chroma of 3 or 4. The depth to interbedded soft sandstone and shale ranges from 20 to 40 inches.

Bresser series

The Bresser series consists of deep, well drained soils that formed in alluvium and residuum weathered from arkosic sedimentary rock. These soils are on hills and ridges. Slopes are 0 to 20 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Bresser soils are similar to the Ascalon, Hargreave, and Truckton soils and are near the Ascalon, Cushman, Hargreave, Truckton, and Stapleton soils. Ascalon soils are calcareous at a depth of 12 to 30 inches. Cushman soils have interbedded shale and sandstone at a depth of 20 to 40 inches. Hargreave soils have soft sandstone at a depth of 20 to 40 inches. Truckton and Stapleton soils have a B horizon that has less than 18 percent clay.

Typical pedon of Bresser sandy loam, 0 to 4 percent slopes, about 2,310 feet north and 660 feet west of the southeast corner of sec. 7, T. 6 S., R. 64 W.:

A11—0 to 4 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A12—4 to 7 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly acid; clear smooth boundary.

B1t—7 to 10 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to weak medium and fine subangular blocky; very hard, friable; thin clay films on vertical faces of peds; slightly acid; clear smooth boundary.

B2t—10 to 20 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; thin continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3t—20 to 29 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; thin patchy clay films on vertical faces of peds; neutral; clear wavy boundary.

C—29 to 60 inches; very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; slightly acid.

Thickness of the solum ranges from 20 to 38 inches. The content of rock fragments, mainly fine and very fine, angular granitic gravel, is 0 to 15 percent in the solum. Reaction is slightly acid or neutral.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 1 to 3. The B2t horizon has value of 5 to 7 dry and 3 to 6 moist and has chroma of 1 to 6. It is commonly sandy clay loam but ranges to clay loam.

Reaction in the C horizon ranges from slightly acid to mildly alkaline. The content of rock fragments ranges from 0 to 35 percent, mainly fine and very fine, angular granitic gravel.

Brussett series

The Brussett series consists of deep, gently sloping, well drained soils that formed in transported silt loam or loam material that was deposited as eolian sediment. These soils are on tablelands. Slopes are 0 to 8 percent. Mean annual precipitation is 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Brussett soils are similar to Holderness soils. They are near Holderness, Peyton, Pring, and Coni soils. Holderness soils have a B2t horizon that has more than 35 percent clay. Peyton and Pring soils have a solum that has more than 15 percent fine sand or coarser. Coni soils have lithic contact at a depth of 20 inches.

Typical pedon of Brussett loam, 0 to 4 percent slopes, about 50 feet south of the northwest corner of sec. 22, T. 10 S., R. 65 W.:

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A12—4 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular blocky structure parting to weak fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B21t—10 to 20 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm; thin clay films on faces of peds; organic staining on faces of peds, especially in the upper 2 inches; neutral; gradual smooth boundary.

B22t—20 to 29 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3—29 to 38 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

Cca—38 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable; visible lime mycelia and soft masses; calcareous; moderately alkaline.

Thickness of the solum ranges from 24 to 50 inches. Reaction of the solum ranges from neutral to moderately alkaline.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 4 to 6 dry and 3 to 5 moist and has chroma of 2 to 4. It is loam or clay loam. The C horizon has a high content of calcareous silt. It is generally loam or silt loam.

Coni series

The Coni series consists of shallow, gently sloping to strongly sloping, well drained soils on upland hills and ridges. These soils formed in sediment of arkose beds overlying hard, cemented conglomerate. Slopes are 4 to 15 percent. Mean annual precipitation ranges from about 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Coni soils are similar to the Bluerim soils and are near the Brussett, Holderness, and Pring soils. Bluerim soils are moderately deep to a paralithic contact. Brussett and Holderness soils are deep. Holderness soils have a B horizon that has more than 35 percent clay. Pring soils do not have a B2t horizon.

Typical pedon of Coni loam, 4 to 15 percent slopes, about 745 feet south and 330 feet west of the center of sec. 24, T. 9 S., R. 65 W.:

A1—0 to 5 inches; brown (7.5YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.

B1—5 to 9 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky; neutral; clear smooth boundary.

B2t—9 to 17 inches; brown (7.5YR 5/2) clay loam, brown (7.5YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky; thin clay films on vertical faces of peds; neutral; clear smooth boundary.

B3—17 to 19 inches; brown (7.5YR 5/2) sandy clay loam, brown (7.5YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky; few thin clay films on faces of peds; neutral; abrupt smooth boundary.

R—19 inches; hard conglomerate sandstone.

Thickness of the solum ranges from 10 to 20 inches. The content of rock fragments is 0 to 35 percent in the solum. Reaction is slightly acid or neutral.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon is typically clay loam but ranges to loam. It has value of 4 to 6 dry and 3 or 4 moist and has chroma of 2 to 4.

Cushman series

The Cushman series consists of moderately deep, well drained soils that formed in mixed calcareous material derived from interbedded shale and sandstone. These soils are on hills and valley sides. Slopes are 0 to 15 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Cushman soils are similar to Bluerim soils. Bluerim soils have a mean annual soil temperature less than 47 degrees F and do not have a calcic horizon. They are near Kutch, Renohill, Ascalon, Hargreave, and Bresser soils. Ascalon and Bresser soils do not have bedrock at a depth of 40 inches. Kutch and Renohill soils have a B2t horizon that has more than 35 percent clay. Hargreave soils have a dark surface layer and are underlain by noncalcareous soft sandstone at a depth of 20 to 40 inches.

Typical pedon of Cushman loam, from an area of Cushman-Ascalon complex, 4 to 15 percent slopes, 100 feet west and 120 feet north of the southeast corner of sec. 26, T. 9 S., R. 60 W.:

Ap—0 to 4 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.

B1—4 to 6 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine subangualar blocky; slightly hard, friable; neutral; clear smooth boundary.

B2t—6 to 13 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable; thin continuous clay films on faces of peds; calcareous; mildly alkaline; clear smooth boundary.

B3ca—13 to 20 inches; grayish brown (10YR 5/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; visible soft masses of lime; calcareous; mildly alkaline; gradual smooth boundary.

C1ca—20 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; visible soft masses of lime; calcareous; moderately alkaline; abrupt smooth boundary.

C2r—34 to 60 inches; olive interbedded shale and sandstone.

Depth to calcareous material ranges from 6 to 10 inches. Depth to interbedded sandstone and shale ranges from 20 to 40 inches.

The A horizon has value of 4 to 6 dry and 3 to 5 moist and has chroma of 2 or 3. The B2t horizon has value of 5 or 6 dry and 4 or 5 moist and has chroma of 2 or 3. It is commonly clay loam but ranges to sandy clay loam.

Elbeth series

The Elbeth series consists of deep, well drained soils that formed in material transported from arkose deposits. Elbeth soils are on upland hills and ridges. Slopes are 4 to 25 percent or more. Mean annual precipitation ranges from about 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Elbeth soils are similar to the Larkson and Plome soils in the adjoining Castle Rock survey area, and are near the Kettle, Peyton, and Pring soils. Larkson soils have a B2t horizon that has more than 35 percent clay. Plome soils have hue of 5YR or redder below the A horizon. The Kettle soils have a B2t horizon in which clay has accumulated as lamellae. Peyton and Pring soils have a mollic epipedon.

Typical pedon of Elbeth sandy loam, 4 to 8 percent slopes, about 2,400 feet south of the northeast corner of sec. 32, T. 7 S., R. 64 W.:

A1—0 to 4 inches; dark gray (10YR 4/1) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

A2—4 to 8 inches; light gray (10YR 7/1) loamy sand, grayish brown (10YR 5/2) moist; weak thin platy structure; soft, very friable; slightly acid; clear wavy boundary.

B1—8 to 13 inches; pale brown (10YR 6/3) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky; slightly acid; clear smooth boundary.

B21t—13 to 24 inches; yellowish brown (10YR 5/4) sandy clay loam, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure parting to moderate coarse angular blocky; extremely hard, firm, sticky and plastic; continuous very dark grayish brown (moist) clay films on peds; medium acid; gradual smooth boundary.

B22t—24 to 56 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak coarse angular blocky structure; very hard, firm, sticky and slightly plastic; thin continuous very dark grayish brown and grayish brown (moist) clay films on peds; slightly acid; diffuse boundary.

B3t—56 to 60 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; weak coarse subangular blocky structure; hard, very friable, slightly sticky; thin discontinuous clay films on some peds; slightly acid.

Thickness of the solum ranges from 24 to 60 inches or more. The content of rock fragments is 0 to 35 percent in the solum. Reaction ranges from strongly acid to neutral.

The solum and the C horizon have hue of 7.5YR to 2.5Y. The A horizon has value of 4 or 5 dry and 2 to 4 moist and has chroma of 1 to 3. The A2 horizon has value of 6 to 7 dry and 4 or 5 moist and has chroma of 1 to 3. The B2t horizon has value of 5 or 6 dry and 4 or 5 moist and has chroma of 2 to 5. It is generally sandy clay loam but ranges from 18 to 35 percent clay.

Ellicott series

The Ellicott series consists of deep, somewhat excessively drained, rapidly permeable soils on first terraces and flood plains. These soils formed in noncalcareous arkosic sandy alluvium. Slopes are 0 to 4 percent. Mean annual precipitation ranges from 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Ellicott soils are similar to Blakeland soils and are near Haplustolls, moderately coarse, nearly level; Haplustolls, loamy, nearly level; Fluvaquents; and Nunn soils. Blakeland; Haplustolls, moderately coarse, nearly level; and Haplustolls, loamy, nearly level, have a mollic epipedon. Fluavaquents have a water table at a depth of 10 to 20 inches. Nunn soils have a mollic epipedon and a fine textured B2t horizon.

Typical pedon of Ellicott loamy coarse sand, 0 to 4 percent slopes, 30 feet south and 1,320 feet east of the northwest corner of sec. 16, T. 6 S., R. 62 W.:

A11—0 to 7 inches; light gray (10YR 7/1) loamy coarse sand, grayish brown (10YR 5/2) moist; single grain; loose; neutral; abrupt smooth boundary.

A12—7 to 14 inches; gray (10YR 6/1) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

AC—14 to 20 inches; light brownish gray (10YR 6/2) loamy sand, brown (10YR 5/3) moist; very weak medium prismatic structure; soft, very friable; neutral; clear smooth boundary.

C1—20 to 26 inches; light gray (10YR 7/1) loamy sand, grayish brown (10YR 5/2) moist; massive to single grain; slightly hard, friable; neutral; abrupt smooth boundary.

C2—26 to 33 inches; light gray (10YR 7/1) loamy coarse sand, light brownish gray (10YR 6/2) moist; massive to single grain; soft, very friable; neutral; abrupt smooth boundary.

C3—33 to 60 inches; light gray (10YR 7/1) loamy coarse sand, grayish brown (10YR 5/2) moist; stratified, thin lenses of coarse sand and coarse sandy loam; massive to single grain; slightly hard, friable; neutral; about 5 percent angular fine gravel.

Typically, these soils are somewhat excessively drained and noncalcareous to a depth of 60 inches or more but may have a water table or free carbonates below a depth of 40 inches in some pedons. Reaction in the control section ranges from mildly alkaline to slightly acid. The content of rock fragments ranges from 0 to 15 percent. The fragments are mainly angular fine gravel.

The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 1 to 4. The C horizon is dominantly loamy sand but is stratified by layers of coarse sandy loam and loamy coarse sand.

Englewood series

The Englewood series consists of deep, well drained soils that formed in clayey alluvium weathered from sedimentary bedrock. Englewood soils are on alluvial fans and valley side slopes. Slopes are 0 to 4 percent. Mean annual precipitation ranges from about 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Englewood soils are similar to the Kutch soils and are near the Heldt and Nunn soils. Kutch soils have shale bedrock at a depth of 20 to 40 inches. Heldt and Nunn soils have a light colored B horizon.

Typical pedon of Englewood clay loam, 0 to 4 percent slopes, about 228 feet north and 786 feet west of the center of sec. 36, T. 7 S., R. 65 W.:

A11—0 to 2 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable; neutral; abrupt smooth boundary.

A12—2 to 4 inches; grayish brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, firm; neutral; clear smooth boundary.

B1—4 to 8 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; neutral; clear smooth boundary.

B21t—8 to 15 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to moderate fine angular blocky; very hard, very firm, plastic; thin clay films on faces of peds; few shiny pressure faces; mildly alkaline; abrupt smooth boundary.

B22t—15 to 29 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate coarse and medium prismatic structure parting to moderate medium angular blocky; extremely hard, extremely firm, very plastic; thin continuous clay films on faces of peds; few shiny pressure faces; mildly alkaline; clear smooth boundary.

B3tca—29 to 40 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; extremely hard, very firm, very plastic; thin patchy clay films on faces of peds; visible streaks and soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cca—40 to 60 inches; light gray (2.5Y 7/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, firm, plastic; visible streaks and soft masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 28 to 40 inches. The content of rock fragments is 0 to 15 percent in the solum but is typically less than 5 percent. Reaction ranges from neutral to moderately alkaline. Cracks ranging from 1/2 to 1 inch in width, at a depth of 20 inches, are common when the soils are dry.

Hue of the solum and the C horizon ranges from 5Y to 10YR. The A horizon has value of 3 to 5 dry and 2 or 3 moist and has chroma of 1 to 3. The B2t horizon has value of 3 to 7 dry and 2 to 6 moist and has chroma of 1 to 6. It ranges from clay loam to clay. The C horizon is moderately alkaline or strongly alkaline.

Fluvaquents

These deep, poorly drained soils are in swales and on creek bottoms. They formed in mixed recent alluvium.

Fluvaquents are similar to Haplustolls, moderately coarse, and near Haplustolls, moderately coarse; Haplustolls, loamy; and Ellicott soils. These soils do not have a water table at a depth of less than 60 inches.

A reference profile of Fluvaquents, nearly level, is about 900 feet north and 350 feet east of the southwest corner of sec. 35, T. 7 S., R. 63 W.:

A11—0 to 6 inches; dark gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

A12—6 to 12 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

C1—12 to 16 inches; light brownish gray (10YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; weak coarse blocky structure; slightly hard, very friable; about 10 percent fine gravel; mildly alkaline; gradual smooth boundary.

C2—16 to 48 inches; pale brown (10YR 6/3) loamy sand stratified with lenses of sand, gravelly sand, and gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; moderately alkaline; gradual smooth boundary.

C3g—48 to 62 inches; greenish gray (5GY 5/1) fine gravel stratified with thin lenses of coarse sand and fine sand, dark greenish gray (5GY 4/1) moist; massive; loose; moderately alkaline.

These soils are stratified and extremely variable in texture, ranging from clay loam to gravelly sand and extending to a depth of 60 inches or more. The water table is at a depth of less than 30 inches most of the year, and these soils are subject to annual flooding during spring and summer.

Haplustolls, moderately coarse

These deep, well drained soils are on stream terraces, mostly along the major streams in the area. They formed in coarse textured noncalcareous alluvium.

Haplustolls, moderately coarse, are similar to Haplustolls, loamy, and near Haplustolls, loamy; Fluvaquents; and Ellicott, Englewood, and Nunn soils. Haplustolls, loamy, have a control section that has 18 to 35 percent clay and is subject to only rare flooding. Fluvaquents have a water table. Ellicott soils are light colored and sandy. Englewood and Nunn soils have a B2t horizon.

A reference profile of Haplustolls, moderately coarse, nearly level, is about 1,150 feet west and 250 feet north of the center of sec. 20, R. 8 S., R. 63 W.:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

A12—6 to 30 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

C1—30 to 36 inches; gray (10YR 5/1) sandy loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; very hard, friable; slight effervescence in a few spots; mildly alkaline; abrupt smooth boundary.

IIC2—36 to 96 inches; light gray (10YR 7/1) loamy sand, light brownish gray (10YR 6/2) moist; massive; soft, very friable; moderately alkaline.

The A horizon ranges from loamy coarse sand to sandy loam. It is commonly stratified. Reaction is neutral or mildly alkaline. The mollic epipedon is at a depth of about 10 to 40 inches. In a few places this soil has a B (cambic) horizon. Strata within the control section ranges from loamy coarse sand to light sandy clay loam, but averages sandy loam or light sandy loam in most pedons. In about 20 percent of the area, the control section and the underlying material average loamy coarse sand to coarse sand.

Haplustolls, loamy

These deep, well drained soils are on stream terraces and fans along drainageways throughout the area. They formed in loamy noncalcareous alluvium.

Haplustolls, loamy, are similar to Haplustolls, moderately coarse, nearly level, and are near Ellicott, Englewood, and Nunn soils. Haplustolls, moderately coarse, have a control section that is less than 18 percent clay and is subject to occasional flooding. Ellicott soils are light colored and sandy. Englewood and Nunn soils have a B2t horizon.

A reference profile of Haplustolls, loamy, nearly level, is about 0.2 mile east and 2,640 feet north of the southwest corner of sec. 19, T. 8 S., R. 64 W.:

A11—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A12—6 to 18 inches; dark gray (10YR 4/1) sandy loam, stratified with thin seams of light colored clay loam, very dark gray (10YR 3/1) moist; weak coarse blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C1—18 to 26 inches; gray (10YR 5/1) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; slightly acid; abrupt smooth boundary.

IIC2—26 to 35 inches; gray (10YR 5/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, firm; slightly acid; abrupt smooth boundary.

IIIC3—35 to 52 inches; gray (10YR 5/2) sandy clay loam stratified with seams of sandy loam, dark gray (10YR 4/1) moist; massive; hard, friable; slightly acid; abrupt smooth boundary.

IVC4—52 to 62 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate medium blocky; slightly acid.

Thickness of the mollic epipedon ranges from 10 to 35 inches. Reaction in the profile is slightly acid or neutral.

The A horizon ranges from fine sandy loam to clay loam. It is commonly stratified. In a few areas these soils have a B (cambic) horizon. The control section is stratified and ranges from sandy loam to clay loam but averages over 18 percent clay.

Hargreave series

The Hargreave series consists of moderately deep, well drained soils that formed in noncalcareous material weathered from soft sandstone. These soils are on ridges and bench edges. Slopes are 0 to 15 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Hargreave soils are similar to Ascalon and Bresser soils. They are near the Cushman soils. Ascalon and Bresser soils do not have bedrock at a depth of 40 inches. Cushman soils have a light colored surface layer.

Typical pedon of Hargreave cobbly sandy loam, in an area of Cushman-Hargreave complex, 8 to 15 percent slopes, about 0.2 mile north and 0.4 mile east of the southwest corner of sec. 22, T. 8 S., R. 65 W.:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; soft, very friable; about 30 percent cobbles; neutral; clear smooth boundary.

B21t—5 to 8 inches; grayish brown (10YR 5/2) sandy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; 10 percent mixed coarse gravel and cobbles; neutral; clear smooth boundary.

B22t—8 to 14 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, firm; neutral; clear smooth boundary.

B3—14 to 18 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear smooth boundary.

C1—18 to 24 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; hard, friable; neutral; abrupt smooth boundary.

C2r—24 inches; arkosic, soft sandstone.

Thickness of the solum ranges from 15 to 23 inches. Depth to bedrock is 20 to 40 inches. Reaction ranges from slightly acid to mildly alkaline. The content of rock fragments, mainly cobble size, ranges from 15 to 35 percent in the A horizon. It is 0 to 20 percent in the B and C horizon.

The solum and C horizon have hue of 2.5Y to 10YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 to 7 dry and 3 to 6 moist and has chroma of 2 to 6.

Heldt series

The Heldt series consists of deep, well drained soils that formed in clayey alluvium. Heldt soils are on stream terraces and alluvial fans. Slopes are 0 to 4 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Heldt soils are similar to Renohill soils. They are near Nunn and Kutch soils. Renohill and Kutch soils have a B2t horizon and have shale bedrock at a depth of 20 to 40 inches. Nunn and Kutch soils have a mollic epipedon.

Typical pedon of Heldt clay loam, 0 to 4 percent slopes, about 0.1 mile east and 125 feet north of the southwest corner of sec. 25, T. 7 S., R. 62 W.:

A1—0 to 2 inches; light brownish gray (2.5Y 6/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; soft, very friable, very plastic, very sticky; mildly alkaline; abrupt smooth boundary.

B1—2 to 5 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable, very plastic, very sticky; mildly alkaline; gradual smooth boundary.

B2—5 to 22 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, firm, very plastic, very sticky; common shiny pressure faces; calcareous; moderately alkaline; gradual smooth boundary.

C1ca—22 to 43 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, very sticky, very plastic; visible thin seams and streaks of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2ca—43 to 65 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, firm, very plastic, very sticky; few gypsum crystals; visible soft masses and thin seams and streaks of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 20 to 50 inches. The content of rock fragments generally is less than 5 percent in the solum but ranges from 0 to 10 percent by volume. Reaction ranges from mildly alkaline to strongly alkaline. Cracks ranging from 0.4 to 1 inch in width are common when the soils are dry.

The solum and the C horizon have hue of 2.5Y or 10YR. The A horizon has value of 5 or 6 dry and 4 or 5 moist and has chroma of 2 or 3. The B2 horizon has value of 5 or 6 dry and 4 or 5 moist and has chroma of 2 or 3. It is commonly clay but ranges to clay loam or silty clay loam.

Holderness series

The Holderness series consists of deep, well drained soils that formed in alluvium derived from arkosic sedimentary rock. Holderness soils are on upland terraces and alluvial fans. Slopes are 0 to 8 percent. Mean annual precipitation is 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Holderness soils are similar to the Brussett soils and are near the Brussett, Coni, Peyton, and Pring soils. Coni soils have bedrock at a depth of less than 20 inches. Brussett and Peyton soils have a B horizon that is 18 to 35 percent clay. Pring soils do not have a B2t horizon.

Typical pedon of Holderness loam, 4 to 8 percent slopes, about 600 feet east and 800 feet north of the center of sec. 17, T. 9 S., R. 64 W.:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B1—4 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky; slightly acid; clear smooth boundary.

B2t—12 to 29 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky; organic stainings along seams between peds; many moderately thick clay films on faces of peds; neutral; gradual smooth boundary.

B3t—29 to 38 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; common thin patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

C1—38 to 47 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

C2—47 to 57 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable; calcareous; mildly alkaline; this is a weak and inconsistent horizon of secondary calcium carbonate in thin seams; gradual smooth boundary.

C3—57 to 60 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, very friable; mildly alkaline.

Thickness of the solum ranges from 20 to 60 inches. The content of rock fragments is 0 to 10 percent in the solum. Reaction ranges from slightly acid to mildly alkaline. The C horizon is mildly alkaline or moderately alkaline. This horizon generally has a weak accumulation of visible secondary calcium carbonate below a depth of about 50 inches.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 or 6 dry and 3 to 5 moist and has chroma of 2 to 4. It is generally clay loam but ranges to clay. The C horizon has hue of 2.5Y or 10YR.

Kettle series

The Kettle series consists of deep, well drained soils that formed in arkosic sandy alluvium. Kettle soils are on fans, hills, valley slopes, and bench edges. Slopes are 8 to 40 percent. Mean annual precipitation is 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Kettle soils are similar to the Elbeth soils. They are near the Coni, Elbeth, Peyton, and Pring soils. Elbeth soils have a continuous B2t horizon that has 18 to 35 percent clay. Coni, Peyton, and Pring soils have a mollic epipedon. Coni soils have bedrock at a depth of 20 inches.

Typical pedon of Kettle loamy sand, in an area of Elbeth-Kettle complex, 8 to 25 percent slopes, about 364 feet south, 1,600 feet west of the northeast corner of sec. 27, T. 10 S., R. 64 W.:

O1—1/2 to 0 inch; partially decomposed organic material consisting mainly of needles, twigs, and bark.

A1—0 to 4 inches; gray (10YR 5/1) loamy sand, very dark gray (10YR 3/1) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.

A2—4 to 22 inches; light gray (10YR 7/1) loamy sand, light brownish gray (10YR 6/2) moist; weak coarse subangular blocky structure parting to weak medium granular; slightly hard, very friable; slightly acid; diffuse wavy boundary.

B2t—22 to 53 inches; light brownish gray (10YR 6/2) coarse sandy loam (composite texture), brown (10YR 5/3) moist; this horizon consists of a matrix of loamy coarse sand in which lamellae of accumulated silicate clay is embedded and has a texture of sandy clay loam or sandy loam; weak coarse subangular blocky structure parting to moderate medium blocky; very hard, friable; thin continuous clay films on peds in lamellae, thin clay films in some pores and occasional clay bridging between sand grains in localized areas; neutral; gradual wavy boundary.

C—53 to 60 inches; very pale brown (10YR 7/4) coarse sand, pale brown (10YR 6/3) moist; massive; hard, very friable; very small content of sticky clay; about 10 percent very fine and fine angular gravel; few large gravel and cobbles; neutral.

Thickness of the solum ranges from 17 to 55 inches. The content of rock fragments is 5 to 35 percent in the solum. Reaction ranges from strongly acid to neutral.

The solum and the C horizon have hue of 10YR or 7.5YR. The A1 horizon, when present, has value of 4 or 5 dry and 3 to 5 moist and has chroma of 1 to 3. The A2 horizon has value of 5 to 8 dry and 4 to 7 moist and has chroma of 1 to 3. The B2t horizon has value of 5 to 8 dry and 4 to 7 moist and has chroma of 2 to 4. Subhorizons that are redder than 7.5YR are in some pedons.

Kutch series

The Kutch series consists of moderately deep, well drained soils that formed in calcareous fine material weathered from clay shale. These soils are on upland hills, ridges, and side slopes. Slopes are 0 to 25 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Kutch soils are similar to Englewood soils. They are near the Louviers, Renohill, and Cushman soils. Englewood soils do not have bedrock at a depth of 20 to 40 inches. Cushman soils have a B horizon that has 18 to 35 percent clay. Cushman, Louviers, and Renohill soils have an ochric epipedon. Louviers soils have bedrock at a depth of less than 20 inches.

Typical pedon of Kutch clay loam, 0 to 4 percent slopes, about 2,280 feet east and 100 feet south of the northwest corner of sec. 32, T. 10 S., R. 60 W.:

A1—0 to 4 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; strong fine and medium granular structure; soft, very friable; neutral; clear smooth boundary.

B1t—4 to 7 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky; few thin patchy clay films on faces of peds; neutral; clear smooth boundary.

B2t—7 to 18 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to strong medium angular blocky; extremely hard, firm, very sticky; thin, nearly continuous clay films on faces of peds; coatings and fillings in root channels and pores; few pressure faces near base of horizon; mildly alkaline; gradual smooth boundary.

B3tca—18 to 22 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; extremely hard, very firm, very sticky; few thin patchy clay films on faces of peds; coatings and fillings in some root channels; few pressure faces; small, soft masses of visible, secondary calcium carbonate; few gypsum crystals; weakly calcareous; moderately alkaline; gradual wavy boundary.

C1ca—22 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; extremely hard, very firm, very sticky; soft concretions and thin streaks and seams of visible calcium carbonate; few gypsum crystals; calcareous; moderately alkaline; clear smooth boundary.

C2r—30 to 60 inches; gray and olive shales; calcareous and containing some crystalline gypsum.

Thickness of the solum ranges from 15 to 40 inches. Depth to bedrock ranges from 20 to 40 inches. Cracks ranging from 0.4 to 1 inch in width are common to a depth of 20 inches. The content of rock fragments is 0 to 15 percent in the solum, but is generally less than 5 percent. Reaction ranges from slightly acid to moderately alkaline.

The solum and the C horizon have hue of 2.5Y or 10YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 or 6 dry and 3 or 4 moist and has chroma of 2 or 3. It is clay or clay loam. The C horizon is moderately alkaline or strongly alkaline.

Louviers series

The Louviers series consists of shallow, well drained soils that formed in weathered noncalcareous shale. Louviers soils are on hills and ridges. Slopes are 8 to 25 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Louviers soils are similar to the Midway soils, mapped in the Elbert County, Eastern Part, and El Paso County soil surveys. They are near Kutch, Renohill, and Cushman soils. Midway soils are calcareous. Kutch, Renohill, and Cushman soils have bedrock at a depth of 20 to 40 inches. Kutch soils have a mollic epipedon.

Typical pedon of Louviers clay, from an area of Renohill-Louviers complex, 8 to 25 percent slopes, about 1,375 feet west and 650 feet north of the southeast corner of sec. 21, T. 9 S., R. 62 W.:

A1—0 to 5 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure parting to moderate fine granular; slightly hard, friable, very sticky, very plastic; neutral; clear smooth boundary.

C1—5 to 14 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; extremely hard, firm, very sticky, very plastic; contains a few gypsum crystals; neutral; abrupt smooth boundary.

C2r—14 to 27 inches; clay shale.

Depth to shale ranges from 8 to 20 inches. The content of rock fragments is 0 to 15 percent in the solum, but is generally less than 5 percent. Reaction ranges from slightly acid to mildly alkaline.

The A horizon has value of 5 or 6 dry and 3 or 4 moist and has chroma of 2 to 4. The C horizon has hue of 2.5Y or 10YR.

Nunn series

The Nunn series consists of deep, well drained soils that formed in mixed clayey alluvium. These soils are on terraces, fans, and toe slopes. Slopes are 0 to 5 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Nunn soils are similar to Weld soils. They are near Englewood, Kutch, and Renohill soils. Weld soils have an abrupt textural change between the A and B horizons. Kutch and Renohill soils have bedrock at a depth of 20 to 40 inches. Englewood soils have a mollic epipedon more than 20 inches thick. Renohill and Heldt soils have an ochric epipedon.

Typical pedon of Nunn clay loam, 0 to 4 percent slopes, about 700 feet east of the center of sec. 4, T. 10 S., R. 62 W.:

Ap—0 to 8 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable; neutral; abrupt smooth boundary.

B1t—8 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm; thin patchy clay films on faces of peds; neutral; clear smooth boundary.

B21t—12 to 19 inches; grayish brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm; thin continuous clay films on faces of peds; moderately alkaline; clear smooth boundary.

B22t—19 to 35 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm; thin continuous clay films on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

B3tca—35 to 40 inches; grayish brown (2.5Y 5/2) silty clay, olive (5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, very firm; few thin patchy clay films on faces of peds; few small, soft calcium carbonate nodules; calcareous; mildly alkaline; abrupt smooth boundary.

IIC1—40 to 55 inches; light brownish gray (2.5Y 6/2) sandy loam, olive (5Y 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable; calcareous; mildly alkaline; abrupt smooth boundary.

IIIC2ca—55 to 60 inches; light olive brown (2.5Y 5/4) silty clay, olive (5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse blocky; extremely hard, firm; streaks and seams of visible secondary calcium carbonate; calcareous; mildly alkaline.

Thickness of the solum ranges from 16 to 40 inches. Depth to calcareous material is 10 to 30 inches. The content of rock fragments is 0 to 10 percent in the solum. Reaction ranges from slightly acid to moderately alkaline.

The solum and the C horizon have hue of 2.5Y or 10YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 to 7 dry and 3 to 6 moist and has chroma of 2 to 4. Texture is heavy clay loam or clay. The C horizon is stratified and commonly is sandy loam to silty clay.

Peyton series

The Peyton series consists of deep, well drained soils that formed in arkosic alluvium and residuum. These soils are on side slopes, fans, hills, and ridges. Slopes are 0 to 15 percent. Mean annual precipitation is 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Peyton soils are similar to Brussett and Holderness soils. They are near Bluerim, Pring, and Elbeth soils. Brussett soils have less than 15 percent fine sand or coarser in the B2t horizon. Holderness soils have more than 35 percent clay in the B2t horizon. Bluerim soils have interbedded sandy shale and sandstone at a depth of 20 to 40 inches. Elbeth soils have an ochric epipedon. Pring soils do not have a B2t horizon and have less than 18 percent clay in the solum.

Typical pedon of Peyton sandy loam, 4 to 8 percent slopes, about 2,495 feet north and 651 feet west of the southeast corner of sec. 31, T. 10 S., R. 63 W.:

A11—0 to 3 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A12—3 to 7 inches; dark grayish brown (10YR 4/2) light sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky; slightly acid; clear smooth boundary.

B21t—7 to 14 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky; thin patchy clay films on faces of peds; neutral; clear smooth boundary.

B22t—14 to 20 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky; thin clay films on vertical faces of peds; neutral; clear smooth boundary.

B3t—20 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky; few thin patchy clay films on vertical faces of peds; neutral; clear smooth boundary.

C1—32 to 49 inches; light brownish gray (10YR 6/2) coarse sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; neutral; abrupt smooth boundary.

C2—49 to 60 inches; white (10YR 8/2) loamy coarse sand, pale brown (10YR 6/3) moist; massive; soft, very friable; neutral.

Thickness of the solum ranges from 24 to 48 inches. The content of rock fragments is 0 to 15 percent in the solum. Reaction ranges from slightly acid to mildly alkaline.

The solum and the C horizon have hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 or 6 dry and 3 to 5 moist and has chroma of 2 to 4. It is typically sandy clay loam, but clay content ranges from 18 to 35 percent. The C horizon is neutral or mildly alkaline.

Pring series

The Pring series consists of deep, well drained soils that formed in arkosic sediment. These soils are on hills, ridges, side slopes, and alluvial fans. Slopes are 4 to 25 percent. Mean annual precipitation is 17 to 19 inches, and mean annual air temperature is about 43 degrees F.

Pring soils are similar to Stapleton soils. They are near Coni, Elbeth, Kettle, and Peyton soils. Stapleton soils have a mean annual soil temperature of more than 47 degrees F. Coni, Elbeth, Kettle, and Peyton soils have a B2t horizon. Elbeth and Kettle soils have an A2 horizon. Coni soils have bedrock at a depth of 20 inches or less.

Typical pedon of Pring sandy loam, 4 to 8 percent slopes, about 825 feet east and 2,260 feet north of the southwest corner of sec. 35, T. 9 S., R. 64 W.:

Ap—0 to 13 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—13 to 18 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

C1—18 to 27 inches; grayish brown (10YR 5/2) coarse sandy loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; hard, friable; neutral; gradual wavy boundary.

C2—27 to 60 inches; grayish brown (10YR 5/2) loamy coarse sand, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; about 5 percent fine angular gravel; neutral.

Thickness of the solum ranges from 10 to 20 inches. The content of rock fragments is 0 to 15 percent. Reaction is slightly acid or neutral.

The solum and the C horizon have hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 1 to 3.

Renohill series

The Renohill series consists of moderately deep, well drained soils that formed in residuum weathered from interbedded shale and sandstone. These soils are on hills and ridges. Slopes are 4 to 20 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Renohill soils are similar to Baca soils. They are near Kutch, Louviers, Truckton, Weld, and Wiley soils. Baca, Truckton, Weld, and Wiley soils are deep. Truckton, Weld, and Kutch soils have a mollic epipedon. Louviers soils have bedrock at a depth of 20 inches or less and do not have an argillic horizon.

Typical pedon of Renohill clay loam, 4 to 8 percent slopes, about 0.4 mile west and 30 feet south of the northeast corner of sec. 18, T. 7 S., R. 61 W.:

A1—0 to 2 inches; grayish brown (2.5Y 5/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky; neutral; clear smooth boundary.

B1t—2 to 5 inches; grayish brown (2.5Y 5/2) clay loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, firm, sticky; thin patchy clay films on faces of peds; neutral; clear smooth boundary.

B2t—5 to 14 inches; light olive brown (2.5Y 5/4) clay, light olive brown (2.5Y 5/4) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, very sticky; thin continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3tca—14 to 24 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky; few thin patchy clay films on faces of peds; some visible secondary calcium carbonate in seams; few small shale fragments; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—24 to 46 inches; varicolored, calcareous, interbedded sandstone and clay shale.

Thickness of solum is from 15 to 30 inches. Depth to bedrock ranges from 20 to 40 inches. The content of rock fragments is 0 to 10 percent in the solum, but is generally less than 5 percent. Reaction is neutral to moderately alkaline.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 or 3. The B2t horizon has hue of 2.5Y or 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 to 5. It is heavy clay loam or clay. The C horizon, when present, has hue of 2.5Y or 10YR. It is moderately alkaline or strongly alkaline.

Stapleton series

The Stapleton series consists of deep, well drained soils that formed in alluvium and residuum weathered from arkosic sedimentary rock. Stapleton soils are on alluvial fans and valley side slopes. Slopes are 8 to 25 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Stapleton soils are similar to Pring soils. They are near the Bresser and Truckton soils. Pring soils have a mean annual soil temperature of less than 47 degrees F. Bresser and Truckton soils have a B2t horizon.

Typical pedon of Stapleton sandy loam, in an area of Bresser-Stapleton sandy loams, 8 to 25 percent slopes, about 1,800 feet north and 30 feet east of the center of sec. 10, T. 9 S., R. 64 W.:

A11—0 to 6 inches; dark gray (10YR 4/1) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; neutral; clear smooth boundary.

A12—6 to 12 inches; dark gray (10YR 4/1) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear smooth boundary.

B2—12 to 37 inches; grayish brown (10YR 5/2) coarse sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky; staining on sand and gravel; about 10 percent fine and very fine gravel; neutral; gradual smooth boundary.

C—37 to 60 inches; light gray (10YR 7/2) gravelly loamy sand, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; 15 percent very fine and fine gravel; neutral.

Thickness of the solum ranges from 12 to 20 inches. The content of rock fragments is 0 to 10 percent in the solum. Reaction is slightly acid or neutral.

The solum and the C horizon have hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 1 to 3. The B2 horizon has value of 5 to 7 dry and 4 to 6 moist and has chroma of 1 to 6.

Torriorthents

These shallow and moderately deep, moderately steep to very steep, well drained to somewhat excessively drained soils are on hills and ridges. They formed in material derived from shale and sandstone. The soils are commonly light colored and have a surface layer ranging from sandy loam to clay loam and underlying material ranging from loamy sand to clay.

A reference profile of Torriorthents is about 2,200 feet north and 800 feet east of the southwest corner of sec. 16, T. 8 S., R. 62 W.:

A1—0 to 6 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary.

C1—6 to 17 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; hard, very friable; neutral; abrupt smooth boundary.

Cr—17 inches; interbedded shale and sandstone.

The A horizon ranges from sandy loam to clay loam, is commonly light colored, and ranges from 2 to 6 inches in thickness. The control section ranges from loamy sand to clay. Reaction is neutral or mildly alkaline.

Truckton series

The Truckton series consists of deep, well drained soils that formed in alluvium and residuum weathered from arkosic sedimentary rock. These soils are on upland terraces, valley side slopes, hills, and ridges. Slopes are 1 to 25 percent. Mean annual precipitation is about 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Truckton soils are similar to the Bresser soils and are near the Bresser, Renohill, and Stapleton soils. Bresser soils have a B horizon that has 18 to 35 percent clay. Renohill soils have a B2t horizon that has more than 35 percent clay and has shale bedrock at a depth of 20 to 40 inches. Stapleton soils do not have a B2t horizon.

Typical pedon of Truckton sandy loam, in an area of Bresser-Truckton sandy loam, 8 to 25 percent slopes, about 650 feet west and 1,485 feet north of the southeast corner of sec. 7, T. 6 S., R. 64 W.:

A1—0 to 3 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

B1—3 to 5 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable, slightly sticky; neutral; clear smooth boundary.

B2t—5 to 15 inches; brown (10YR 4/3) heavy sandy loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, very friable, slightly sticky; thin patchy clay films on faces of peds; neutral; clear smooth boundary.

B3t—15 to 20 inches; yellowish brown (10YR 5/4) coarse sandy loam, yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; few thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

C—20 to 60 inches; very pale brown (10YR 7/4) loamy coarse sand, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; neutral; gradual smooth boundary.

Thickness of the solum ranges from 16 to 40 inches. Reaction ranges from slightly acid to mildly alkaline.

The solum and the C horizon have hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 1 to 3. The B2t horizon has value of 5 to 7 dry and 3 to 6 moist and has chroma of 1 to 6.

Weld series

The Weld series consists of deep, nearly level to moderately sloping, well drained soils that formed in silty eolian material. Weld soils are on tableland. Slopes are 0 to 8 percent. Mean annual precipitation is about 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Weld soils are similar to the Nunn soils and are near the Ascalon, Baca, and Bresser soils. Nunn and Baca soils have a gradual textural change between the A horizon and the B horizon. Ascalon and Bresser soils contain more sand and have 18 to 35 percent clay in the B horizon. Bresser soils are noncalcareous.

Typical pedon of Weld loam, 0 to 4 percent slopes, about 10 feet south of U. S. Geological Survey bench marker, east side of road, 2,640 feet north and 1,150 feet west of the southeast corner of sec. 34, T. 6 S., R. 61 W.:

A1—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

B22t—5 to 12 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong medium subangular blocky; extremely hard, very firm, very sticky, very plastic; continuous clay films on faces of peds; neutral; gradual smooth boundary.

B23t—12 to 15 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky, plastic; continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3tca—15 to 19 inches; pale brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium blocky; very hard, firm, sticky, plastic; thin clay films on vertical faces of peds; common medium soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C1ca—19 to 45 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm; common medium soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2ca—45 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; common medium soft masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 15 to 40 inches. The content of rock fragments typically is less than 2 percent in the solum, but ranges from 0 to 10 percent. Reaction is neutral to moderately alkaline. Reaction in the C horizon is moderately alkaline or strongly alkaline.

The solum and the C horizon have hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and has chroma of 2 or 3. The B2t horizon has value of 5 to 7 dry and 3 to 6 moist and has chroma of 3 or 4. It is generally clay but ranges to silty clay and silty clay loam. The C horizon is silty clay loam, silt loam, or loam.

Wiley series

The Wiley series consists of deep, well drained soils that formed in calcareous silty eolian material. Wiley soils are on upland terraces, hills, ridges, and valley side slopes. Slopes are 0 to 8 percent. Mean annual precipitation is 14 to 17 inches, and mean annual air temperature is about 47 degrees F.

Wiley soils are similar to the Cushman soils and are near the Baca soils. Cushman soils have interbedded shale and sandstone at a depth of 20 to 40 inches. Baca soils have a B horizon that has more than 35 percent clay.

Typical pedon of Wiley loam, in an area of Wiley-Baca loams, 4 to 8 percent slopes, about 1,450 feet west and 130 feet south of the northeast corner of sec. 23, T. 6 S., R. 60 W.:

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky; mildly alkaline; abrupt smooth boundary.

B21t—3 to 6 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky; thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

B22tca—6 to 18 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky; few thin patchy clay films on faces of peds; few visible soft masses of secondary calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B3ca—18 to 29 inches; very pale brown (10YR 7/3) silty clay loam, light brownish gray (10YR 6/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky; many visible seams and soft masses of secondary calcium carbonate; calcareous; strongly alkaline; gradual smooth boundary.

C1—29 to 38 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky; calcareous; strongly alkaline; gradual smooth boundary.

C2—38 to 60 inches; very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky; calcareous; strongly alkaline.

Thickness of the solum ranges from 15 to 40 inches. Reaction ranges from neutral to strongly alkaline. Reaction in the C horizon is moderately alkaline or strongly alkaline.

The solum and the C horizon have hue of 2.5Y or 10YR. The A horizon has value of 5 to 7 dry and 3 to 5 moist and has chroma of 2 or 3. The B2t horizon has value of 5 to 7 dry and 4 to 6 moist and has chroma of 2 or 3. It is typically silty clay loam but ranges to silt loam and clay loam.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boralf (*Bor*, meaning cool, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Eutroboralfs (*Eutro*, meaning high base saturation, plus *boralf*, the suborder of Alfisols that have a cold temperature regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Eutroboralfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed Typic Eutroboralfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section, the processes of soil formation are discussed and related to the soils in the survey area.

Soil is produced by the action of soil-forming processes on parent material that was deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by the interaction of five factors of soil formation (*3*)—the physical and mineralogical composition of the parent material, the climate under which the soil material accumulated and weathered, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil development have acted on the soil material.

All of these factors are highly complex and are interdependent, each modifying the effectiveness of the other. Relief influences, through drainage and runoff, the effects of rainfall and time. The character of the parent material modifies the effects of these, particularly rainfall. It is apparent that soil-forming factors do not all function with the same intensity or in the same combination. The result is soils having different characteristics.

Parent material

Differences in physical, chemical, and mineralogical properties of parent material have influenced soil formation in Elbert County, Western Part. Parent material also determines the texture, color, consistence, and other soil characteristics.

The geologic formations exposed in the survey area are of sedimentary origin and range in age from upper Cretaceous to Quaternary. The bedrock formations consist primarily of sandy shales and clays, soft arkosic sandstones, and hard conglomeratic sandstones of Upper Cretaceous and early Tertiary age. They include the Laramie Formation, Dawson Formation, and Castle Rock Conglomerate. The Dawson Formation is the most widespread of these formations and underlies more than 90 percent of the area. The Laramie Formation crops out only in a few places along East Bijou Creek on the eastern side of the survey area.

Quaternary deposits consist of unconsolidated alluvial, colluvial, and eolian materials of the Pleistocene age and the Recent age. Deposits of the Pleistocene age include sandy, gravelly, and clayey alluvium on stream terraces, as well as eolian silt and sand. Deposits of the Recent age include alluvium along stream flood plains and colluvium along valley side slopes.

The Laramie Formation is of the Upper Cretaceous age and consists of a series of beds of dark to light gray clay and shale interlayered with light gray to brown sandstone. The Laramie Formation crops out only in a few cutbanks along East Bijou Creek at the eastern side of the survey area. It has the least effect on the formation of soils in the survey area. The Renohill series is representative of the soils that formed in material weathered from this formation.

The Dawson Formation is of the Upper Cretaceous age and the Paleocene age. The upper part of the formation may be of the Eocene age. It differs markedly from the lower part in that it consists predominantly of light colored, coarse grained arkosic sandstone. The lower part, however, consists chiefly of clay and sandy shale that has many lenticular beds of fine grained sandstone. The maximum thickness of the Dawson Formation in the survey area is 2,000 feet. The boundary separating the lower and upper parts is near the middle of the formation.

The lower part of the Dawson Formation crops out mainly in the eastern half of the survey area in the drainage basins of West Bijou, Middle Bijou, Wilson, East Bijou, and Big Sandy Creeks. It consists of clay and sandy clay, dark carbonaceous and lignitic shales, many lenticular beds of fine to medium grained arkosic sandstone, and some conglomeratic sandstones. The predominant colors are various shades of gray and brown. Several thin coal beds are also present. The most persistent is near the top of the lower part of the Dawson Formation. The Cushman, Kutch, Louviers, and Renohill series are representative of soils that weathered from material of this formation.

The upper part of the Dawson Formation crops out throughout most of the western part of the survey area in the drainage basins of Coal, Running, Kiowa, and Comanche Creeks. It consists of white to light gray and green, coarse grained arkosic sandstone and of conglomerate that contains pebbles of quartz and pink to light gray feldspar that derived from the granite of the Colorado Front Range. Some light green to greenish gray sandy shale and claybeds and one or two thin coalbeds are also present.

Throughout the area is a very distinctive bed of pink to red clay in the lower section of the upper part of the Dawson Formation. This bed ranges from a few inches to several feet in thickness and is about 200 feet above the lowest bed of light colored, coarse grained arkose that marks the base of the upper part of the formation. Along the western edge of the survey area and into the Castle Rock area, beds of light gray and pink rhyolitic welded tuff are near the top section of the upper part of the Dawson Formation. The Bluerim, Bresser, Elbeth, Hargreave, Kettle, Peyton, Pring, Stapleton, and Truckton series are representative of the soils that weathered from material of the upper part of this formation.

The Castle Rock Conglomerate is of the Oligocene age. The lower part consists of a hard arkosic conglomerate, and the upper part consists of coarse arkosic sandstone that has thinner beds of conglomerate. Pebbles and cobbles or rhyolitic welded tuff, derived from the upper part of the Dawson Formation are common throughout the survey area. The Castle Rock Conglomerate crops out in the southwestern part of the survey area in the upper reaches of Running, Kiowa, and Comanche Creeks. The Coni series is representative of the soils on this formation.

Unconsolidated surficial deposits of the Pleistocene and the Recent ages are widely distributed in the survey area. They include sandy, gravelly, and clayey alluvium on terraces along streams, in wind-laid silt and sand on uplands, in colluvium on valley slopes, and in alluvium on stream flood plains.

The oldest Quaternary deposits in the survey area are probably of the early and middle periods in the Pleistocene age. They consist of sandy and gravelly alluvium that is on interstream divides, ranging from 200 to 300 feet above modern stream channels. Most of the material in these deposits was derived from the upper part of the Dawson Formation. A series of sandy, gravelly, and clayey alluvial deposits of the late period in the Pleistocene age underlies stream terraces along most of the major streams. The Ascalon, Bresser, Englewood, Heldt, Holderness, Kettle, Nunn, Peyton, Stapleton, and Truckton series are representative of the soils that weathered from these deposits.

Most of the eolian deposits in the survey area are probably of the later period in the Pleistocene (Wisconsin) age and consist of silt and fine sand, which mantle most of the flatter upland areas. Developing on these deposits are the Baca, Brussett, Weld, and Wiley series.

Deposits interpreted as being principally of the Recent age are alluvium in the flood plains of most streams, slopewash colluvium throughout the area, and minor deposits of eolian silt and sand. Representative of these deposits are the Ellicott series; the Fluvaquents and Haplustolls, moderately coarse; and Haplustolls, loamy.

Climate

The climate of Elbert County, Western part, is a semiarid, continental type. Winters are cold and dry, and summers are cool and relatively dry. Mean annual air temperature, as measured at the Elbert weather station, is 44.5 degrees F, and mean summer air temperature is 63.6 degrees F. Average annual precipitation is about 17 inches. Mean annual air temperature at Parker 9E, in the northwest corner of Elbert County, is 46.5 degrees F, and mean summer air temperature is 67 degrees F. Average annual precipitation is about 14 inches. Mean annual air temperature as measured at Calhan, 11 miles west of Simla and 6 miles south of the Elbert County line, is 45.7 degrees F, and mean summer air temperature is 65 degrees. Average annual precipitation is about 16 inches.

The western part of Elbert County receives its greatest precipitation during spring and summer. Autumn and winter are relatively dry. The evaporation rate generally exceeds precipitation, except for brief periods following summer rains.

Temperature and rainfall govern the rates of the weathering of rocks and of the decomposition of minerals. They also influence leaching, eluviation, and illuviation. Thus, climate has a direct effect on the accumulation of parent material and the differentiation of horizons. The indirect effects of climate are its controls over the kind of plants and animals that can thrive in a region. Mainly temperature affects the growth of vegetation and physical soil properties. Forty-one degrees is commonly accepted as the temperature that separates periods of low biologic activity from the periods of high activity.

Plant and animal life

Living organisms—plants, animals, insects and micro-organisms—are active in the soil forming processes.

Plants largely determine the kinds and amounts of organic matter that enter the soil under natural conditions. They also govern the way in which it will be added, whether as leaves and twigs on the surface or as fibrous roots within the soil profile.

In the survey area, plant cover consists of grass and trees. The grass vegetation returns a large amount of organic matter to the soil by the decomposition of the plant roots as well as by annual additions of leaves and stems to the surface. This results in dark horizons that are high in organic matter content.

Some soils in the survey area, mainly in the southwestern part, developed under forest type vegetation. Two soils that have developed under forests are the Elbeth and Kettle soils. There is an annual return of organic matter, which decomposes in the presence of calcium ions. Because the forest is relatively open and has an undergrowth of shrubs and grasses, the soils do not have the acid characteristics common to many of the soils formed under forest. The amount of organic matter that is returned annually and the speed with which it decomposes is considerably less in the forested areas than in the areas that are under grass. Consequently, the soils generally have either very thin, dark horizons or light colored horizons in which organic matter decreases sharply as depth increases.

Mixing of soil horizons is often the result of burrowing animals, insects, and earthworms. One of the most important functions of micro-organisms is that of changing raw vegetative matter into soil organic matter.

Man's use of land effectively modifies the soil forming factors. He directly alters the character of the soil by cultivation, fertilization, irrigation, or drainage or by removal of parts of the soil. He alters the soil indirectly by controlling water movement or vegetative cover.

Relief

Relief, or lay of the land, affects runoff and drainage. Other things being equal, runoff is more prevalent on steep soils than on nearly level or level soils. The amount of water that moves through the soil depends partly on slope. As a rule, more water runs off and less enters steep soils than it does on gently sloping soils. Steep soils generally have a thinner surface layer and less development in the subsoil than nearly level soils.

The direction of slope is also important in the formation of soils. South-facing slopes are warmer, have a higher rate of evaporation, and generally have less vegetation than the north-facing slopes.

Time

Time is required for soil formation. The length of time depends, to a large extent, on the kind of parent material, climate, vegetation, and relief. Soils develop faster in humid areas than in arid areas where precipitation is light and vegetation is scanty and where winds are active in moving and re-depositing soil material. Steep soils on mountains are normally young in terms of years and stage of development because of rapid erosion. Soils on flood plains are also young because of the almost continuous accumulation of material.

Depending upon its permeability and chemical nature, parent material may affect time. If the parent material has slow permeability, more time will be needed for soil development. Profile development is largely dependent upon the amount of water that passes through the soil.

The Ascalon, Baca, Bresser, and Weld soils are among the oldest in the survey area. They have more distinct genetic horizons than the younger soils, such as the Ellicott, Haplustolls, moderately coarse, and Louviers soils.

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Glossary

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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Badland. Steep or very steep, commonly nonstony barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

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 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 frequent flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, 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 vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). 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 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Favorable. Favorable soil features for the specified use.

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.

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.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage 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.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

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.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming 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.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

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 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.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

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 strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

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. Mottling generally indicates poor aeration and impeded drainage. 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).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to 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.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

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 runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

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.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface that 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 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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, to provide protection from soil blowing 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. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. 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."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a 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 sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

ILLUSTRATIONS

Figure 1.—Contour stripcropping on Bresser sandy loam, 4 to 8 percent slopes.

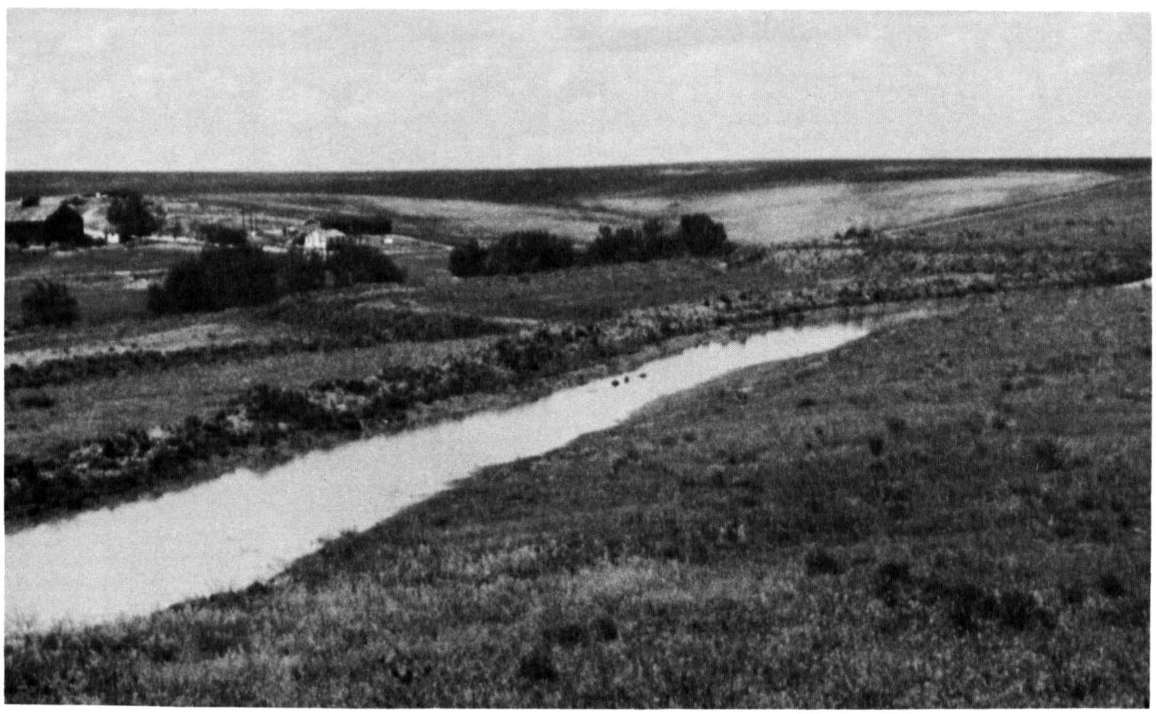

Figure 2.—Terraces on Bresser sandy loam, 4 to 8 percent slopes.

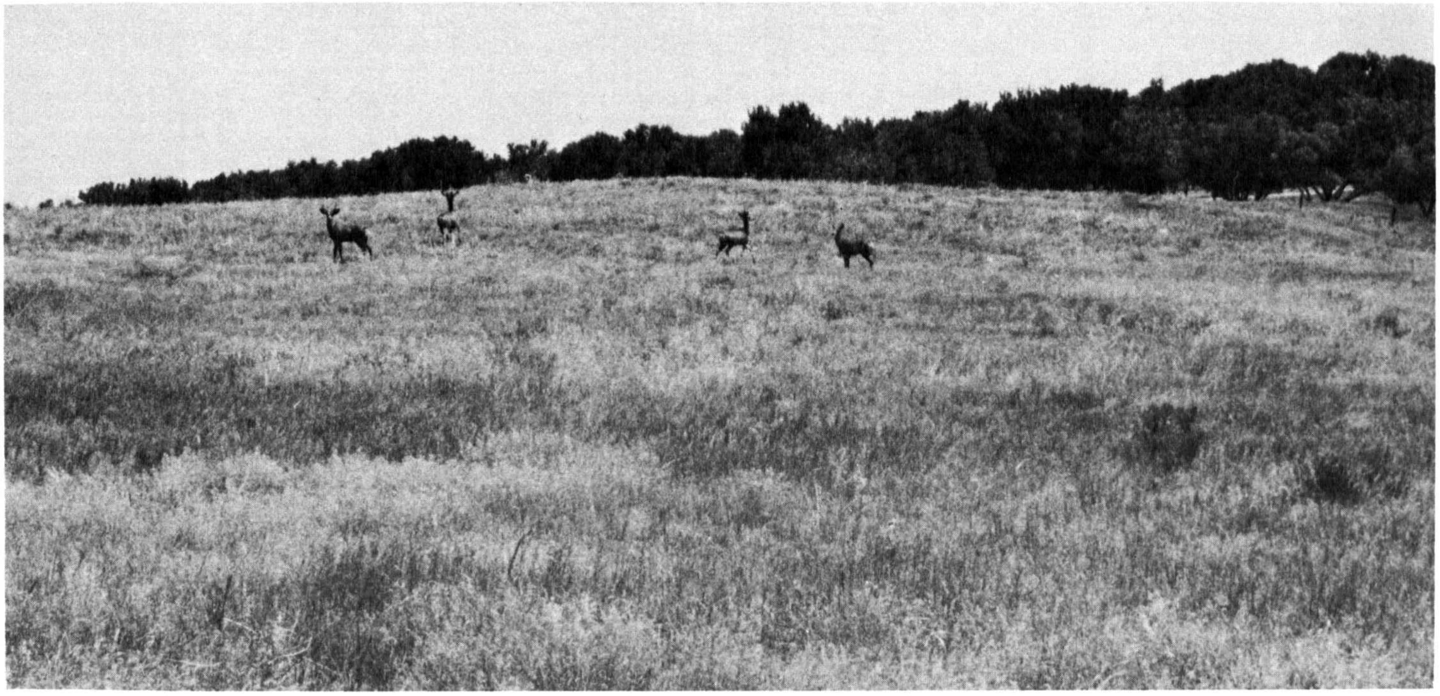

Figure 3.—Deer on Bresser sandy loam, 4 to 8 percent slopes. Cottonwood trees in the background are growing along Wolf Creek in Haplustolls, moderately coarse, nearly level.

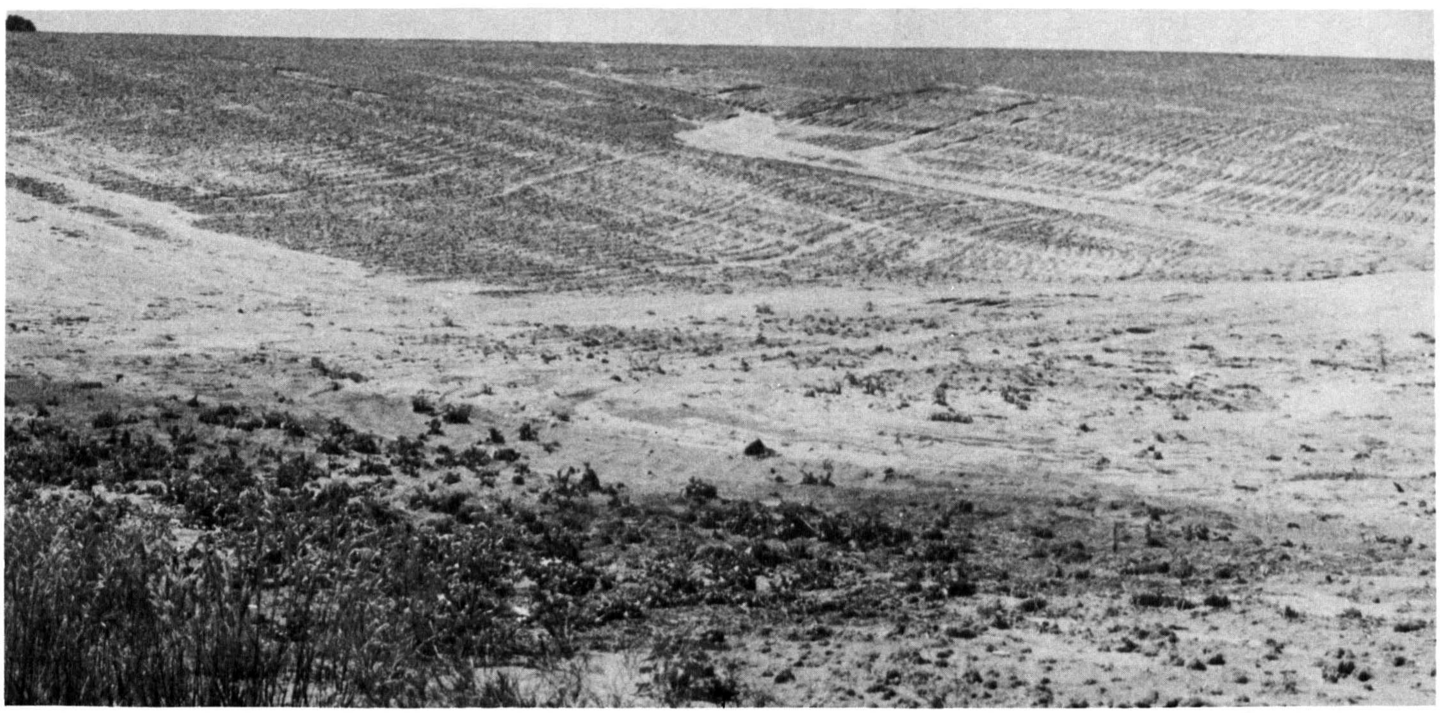

Figure 4.—Eroded cropland on Bresser sandy loam, 4 to 8 percent slopes.

Figure 5.—Sandstone outcrop on Cushman-Kutch complex, 8 to 25 percent slopes.

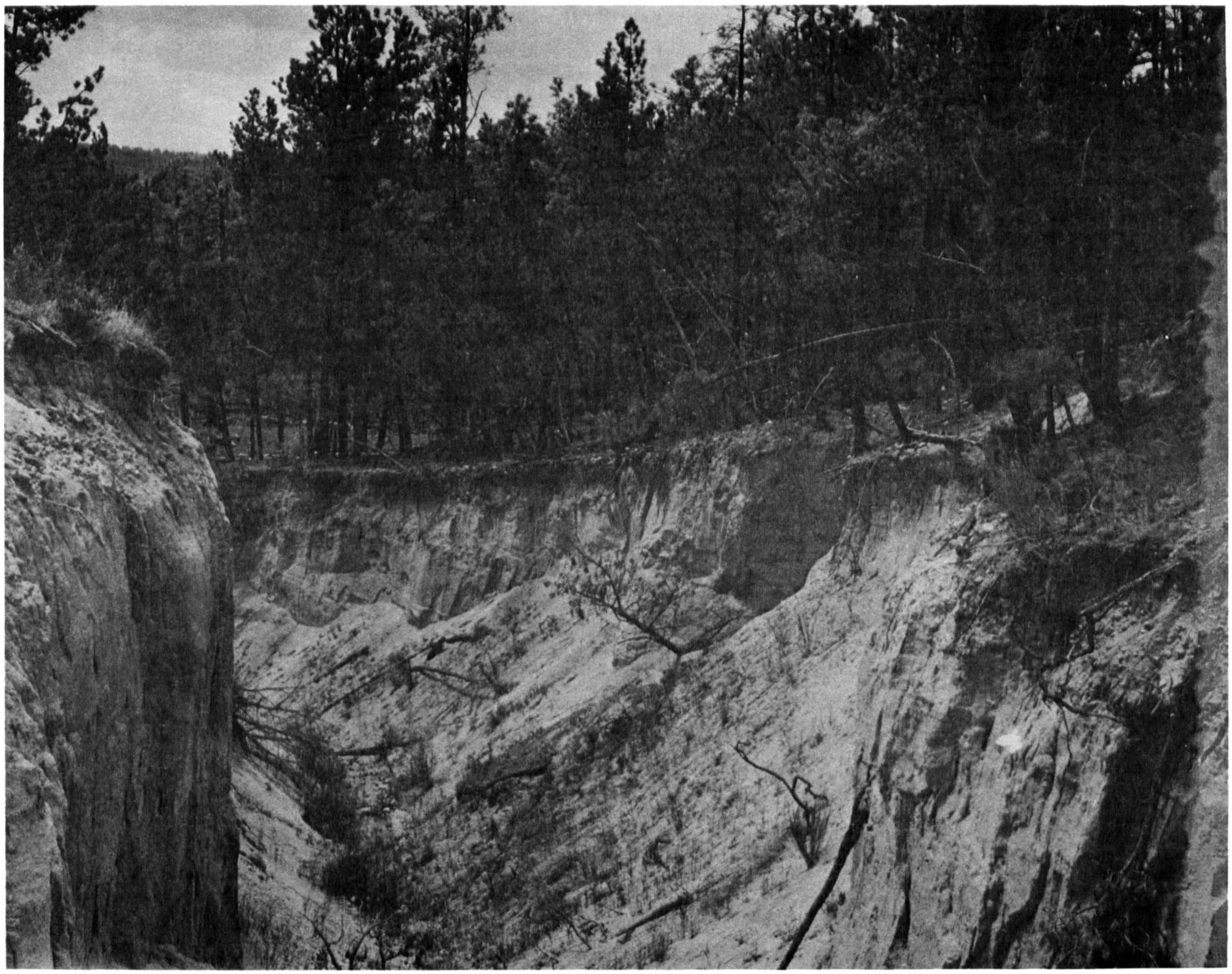

Figure 6.—Gullied area on the Elbeth-Kettle complex, 8 to 25 percent slopes.

Figure 7.—Elbeth-Kettle complex, 8 to 25 percent slopes, in the foreground and Kettle-Rock outcrop complex, 15 to 65 percent slopes, in the background. Light colored ponderosa pine trees have been killed by the pine beetle.

Figure 8.—Subirrigated native hay meadow on Fluvaquents, nearly level, along Running Creek.

Figure 9.—Cottonwood trees growing on Haplustolls, moderately coarse, nearly level, along West Bijou Creek. This area is a good wildlife habitat.

Figure 10.—Alfalfa field on Haplustolls, loamy, nearly level. Trees in the background are growing on Ellicott loamy coarse sand, 0 to 4 percent slopes, and Haplustolls, moderately coarse, nearly level.

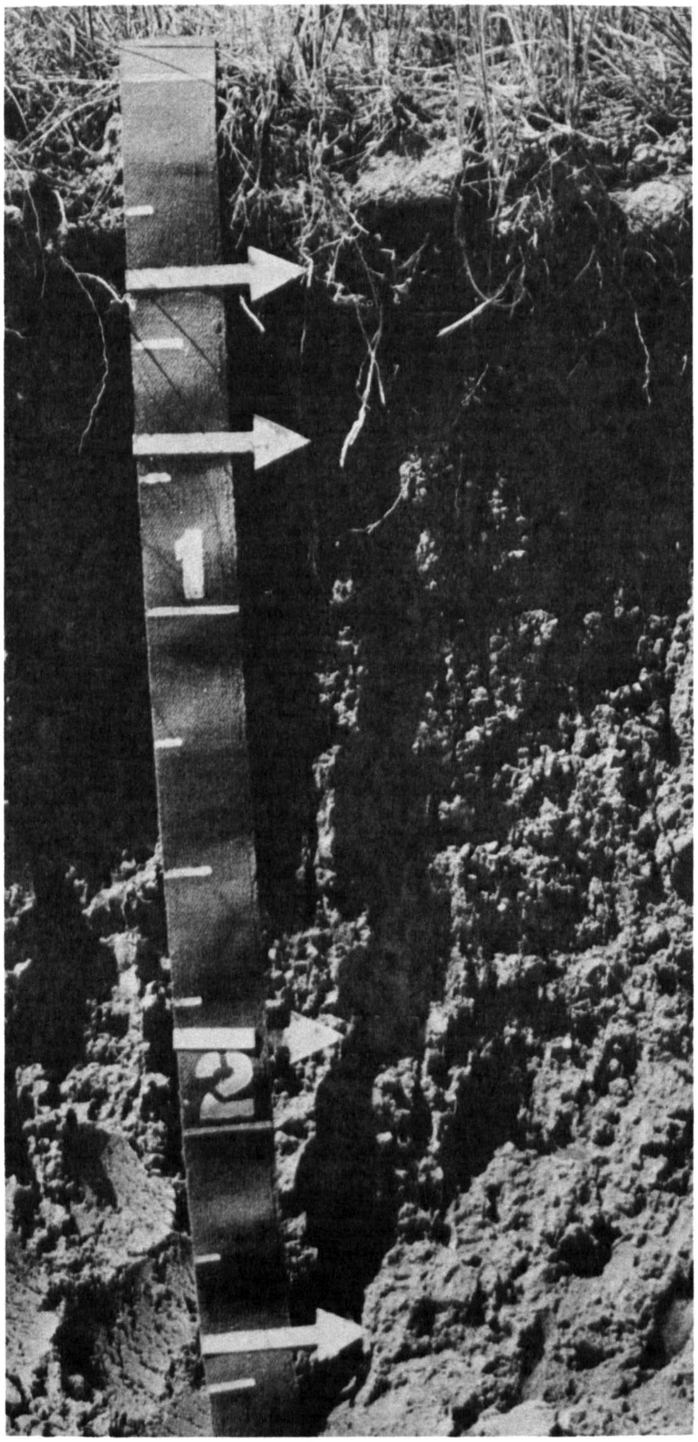

Figure 11.—Profile of Holderness loam.

Figure 12.—Profile of Kettle loamy sand, showing lamellae in the subsoil.

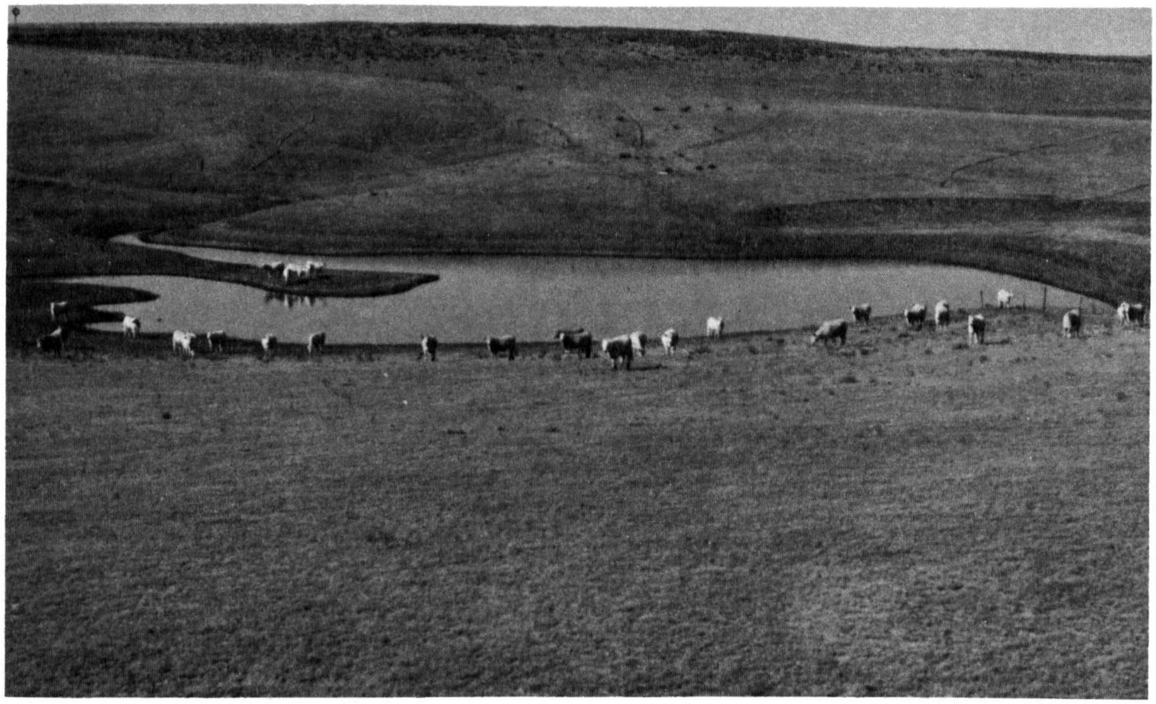

Figure 13.—Cattle grazing on Kutch clay loam, 4 to 8 percent slopes. The ridge in the background is Bresser-Truckton sandy loams, 8 to 25 percent slopes.

Figure 14.—Terraces on Peyton sandy loam, 4 to 8 percent slopes. Snow accumulated on the back side of terraces.

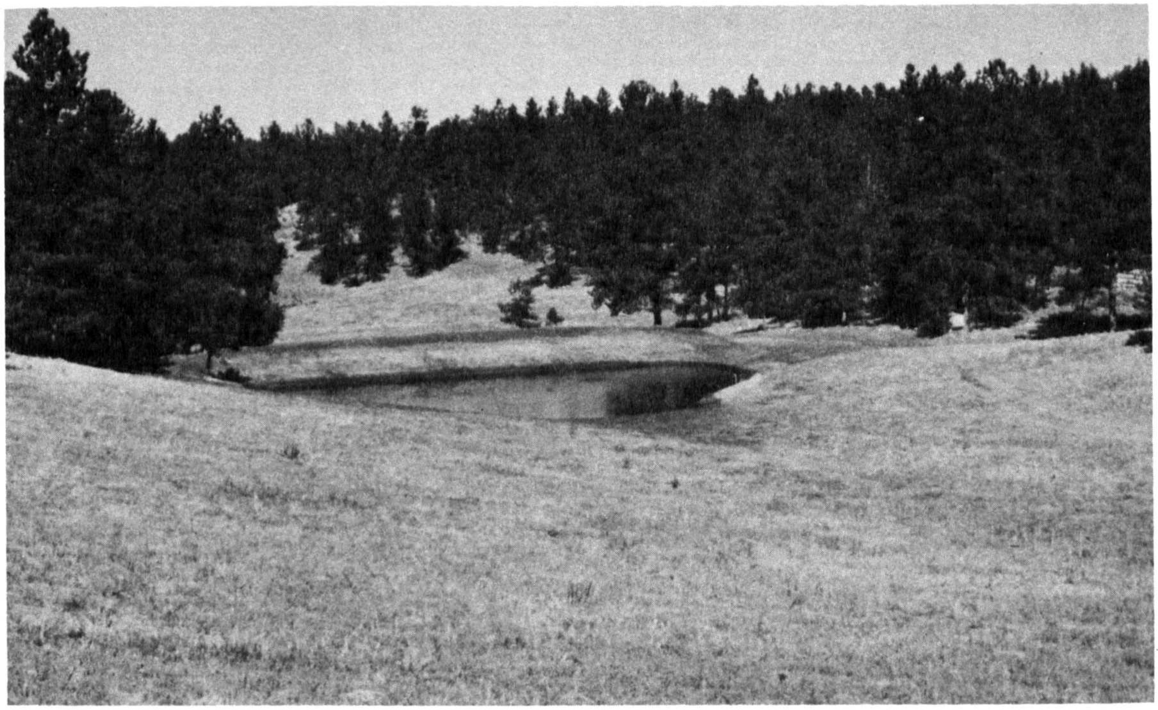

Figure 15.—Stockwater dam on Peyton-Elbeth sandy loams, 8 to 25 percent slopes. Trees are growing on the Elbeth soil.

Figure 16.—Eroded side slope of Torriorthents-Rock outcrop complex, steep, showing interbedded shale and sandstone.

Figure 17.—Landscape of Torriorthents-Rock outcrop complex, steep.

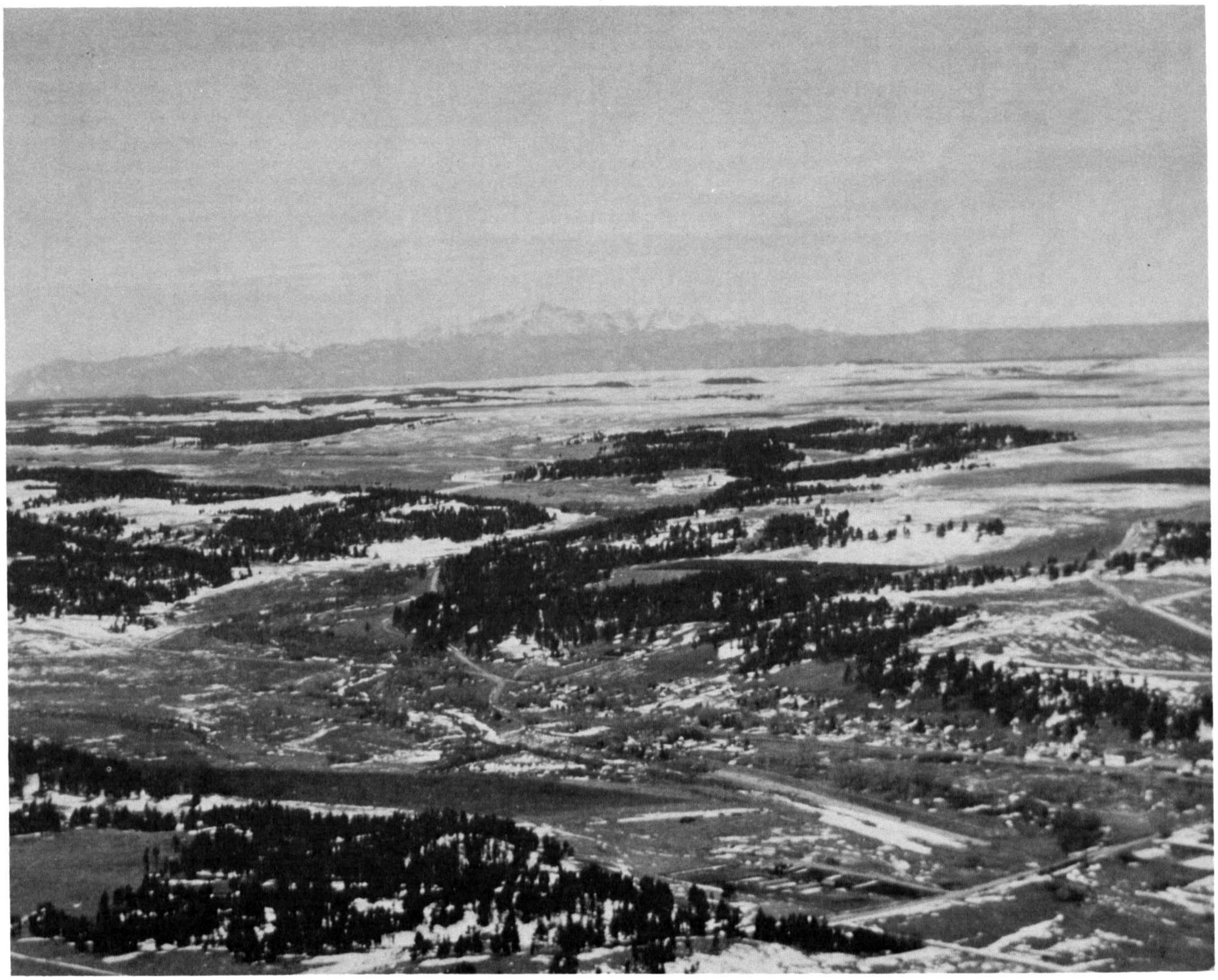

Figure 18.—View of the southwestern part of Elbert County. Open areas are in the Loamy Park and the Sandy Divide range sites. The wooded areas are on Elbeth and Kettle soils. Pikes Peak is in the background.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1963-74 at Elbert, Colorado]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	43.0	8.4	25.7	64	-31	14	.45	.23	.62	2	9.3
February---	44.6	11.0	27.9	67	-14	16	.60	.17	.94	2	8.0
March------	49.3	17.0	33.2	75	-11	76	.91	.52	1.22	4	13.7
April------	58.4	25.9	42.2	77	4	145	1.76	.65	2.65	4	11.1
May--------	68.0	34.3	51.2	86	15	351	2.12	.76	3.20	5	1.8
June-------	76.3	42.8	59.6	93	27	588	2.34	.72	3.63	6	.1
July-------	82.6	50.4	66.5	94	38	822	2.93	1.84	3.91	8	.0
August-----	79.9	49.2	64.6	92	30	763	2.15	1.37	2.85	6	.0
September--	72.3	39.0	55.7	87	20	471	1.67	.88	2.31	4	1.8
October----	63.8	28.6	46.2	82	3	238	.92	.27	1.43	2	8.3
November---	51.2	17.8	34.5	74	-6	55	.76	.24	1.17	2	7.6
December---	43.5	9.8	26.7	66	-20	0	.71	.23	1.09	2	10.2
Year------	61.1	27.9	44.5	96	-29	3,539	17.32	13.51	20.91	47	71.9

[1]A growing degree day is an index of the amount 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 (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1963-74 at Elbert, Colorado]

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	June 9	June 11	June 22
2 years in 10 later than--	June 1	June 4	June 16
5 years in 10 later than--	May 17	May 23	June 5
First freezing temperature in fall:			
1 year in 10 earlier than--	September 19	August 30	August 13
2 years in 10 earlier than--	September 25	September 7	August 22
5 years in 10 earlier than--	October 6	September 21	September 9

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1963-74 at Elbert, Colorado]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	111	88	63
8 years in 10	121	99	74
5 years in 10	141	121	95
2 years in 10	161	142	116
1 year in 10	171	154	127

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Ascalon sandy loam, 0 to 4 percent slopes	1,430	0.2
2	Ascalon sandy loam, 4 to 8 percent slopes	9,350	1.5
3	Baca-Wiley loams, 0 to 4 percent slopes	8,870	1.4
4	Bluerim-Peyton sandy loams, 8 to 20 percent slopes	8,910	1.4
5	Bresser sandy loam, 0 to 4 percent slopes	21,810	3.4
6	Bresser sandy loam, 4 to 8 percent slopes	114,500	17.8
7	Bresser-Cushman complex, 4 to 20 percent slopes	14,100	2.2
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	16,720	2.6
9	Bresser-Truckton sandy loams, 8 to 25 percent slopes	65,690	10.3
10	Brussett loam, 0 to 4 percent slopes	11,570	1.8
11	Brussett loam, 4 to 8 percent slopes	10,410	1.6
12	Coni loam, 4 to 15 percent slopes	9,930	1.6
13	Cushman loam, 0 to 4 percent slopes	800	0.1
14	Cushman-Ascalon complex, 4 to 15 percent slopes	37,160	5.8
15	Cushman-Hargreave complex, 8 to 15 percent slopes	20,820	3.3
16	Cushman-Kutch complex, 8 to 25 percent slopes	30,000	4.7
17	Elbeth sandy loam, 4 to 8 percent slopes	6,620	1.0
18	Elbeth-Kettle complex, 8 to 25 percent slopes	8,570	1.3
19	Ellicott loamy coarse sand, 0 to 4 percent slopes	9,490	1.5
20	Englewood clay loam, 0 to 4 percent slopes	1,260	0.2
21	Fluvaquents, nearly level	510	0.1
22	Haplustolls, moderately coarse, nearly level	10,950	1.7
23	Haplustolls, loamy, nearly level	17,270	2.7
24	Heldt clay loam, 0 to 4 percent slopes	8,330	1.3
25	Holderness loam, 0 to 4 percent slopes	1,370	0.2
26	Holderness loam, 4 to 8 percent slopes	1,090	0.2
27	Kettle loamy sand, 8 to 15 percent slopes	710	0.1
28	Kettle-Rock outcrop complex, 15 to 65 percent slopes	5,940	0.9
29	Kutch clay loam, 0 to 4 percent slopes	3,480	0.5
30	Kutch clay loam, 4 to 8 percent slopes	21,840	3.4
31	Kutch-Louviers complex, 8 to 25 percent slopes	11,840	1.9
32	Nunn clay loam, 0 to 4 percent slopes	26,180	4.1
33	Nunn clay loam, 4 to 8 percent slopes	8,670	1.4
34	Peyton sandy loam, 4 to 8 percent slopes	10,340	1.6
35	Peyton-Elbeth sandy loams, 8 to 25 percent slopes	14,060	2.2
36	Peyton-Pring complex, 8 to 25 percent slopes	9,080	1.4
37	Pring coarse sandy loam, 4 to 8 percent slopes	1,020	0.2
38	Renohill clay loam, 4 to 8 percent slopes	1,910	0.3
39	Renohill-Louviers complex, 8 to 25 percent slopes	10,750	1.7
40	Torriorthents-Rock outcrop complex, steep	3,380	0.5
41	Truckton sandy loam, 4 to 8 percent slopes	11,570	1.8
42	Truckton-Renohill complex, 8 to 25 percent slopes	5,800	0.9
43	Weld loam, 0 to 4 percent slopes	20,710	3.2
44	Weld loam, 4 to 8 percent slopes	6,790	1.1
45	Wiley-Baca loams, 4 to 8 percent slopes	18,360	2.9
	Total	639,960	100.0

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1, 2. Ascalon	Sandy Foothills	Favorable	1,500	Prairie sandreed	20
		Normal	1,200	Needleandthread	15
		Unfavorable	800	Sideoats grama	15
				Blue grama	15
				Little bluestem	15
				Sand bluestem	5
				Big bluestem	5
				Sand sagebrush	5
3*:					
Baca	Loamy Foothills	Favorable	1,600	Western wheatgrass	35
		Normal	1,100	Blue grama	25
		Unfavorable	800	Green needlegrass	10
				Sideoats grama	10
				Prairie junegrass	10
Wiley	Loamy Foothills	Favorable	1,600	Western wheatgrass	35
		Normal	1,100	Blue grama	25
		Unfavorable	800	Prairie junegrass	10
				Green needlegrass	10
				Sideoats grama	10
4*:					
Bluerim	Sandy Divide	Favorable	2,000	Blue grama	15
		Normal	1,200	Prairie sandreed	15
		Unfavorable	700	Needleandthread	15
				Little bluestem	10
				Bluegrass	5
				Sand bluestem	5
				Indian ricegrass	5
				Prairie junegrass	5
Peyton	Sandy Divide	Favorable	2,500	Mountain muhly	25
		Normal	1,500	Sand bluestem	10
		Unfavorable	900	Little bluestem	10
				Prairie sandreed	10
				Blue grama	10
				Prairie junegrass	10
				Western wheatgrass	10
5, 6. Bresser	Sandy Foothills	Favorable	1,800	Prairie sandreed	20
		Normal	1,500	Blue grama	15
		Unfavorable	1,000	Needleandthread	10
				Little bluestem	10
				Prairie junegrass	10
				Sideoats grama	10
				Sand bluestem	5
				Sand dropseed	5
				Western wheatgrass	5
				Fringed sagebrush	5
7*:					
Bresser	Sandy Foothills	Favorable	1,800	Prairie sandreed	20
		Normal	1,500	Blue grama	15
		Unfavorable	1,000	Needleandthread	10
				Little bluestem	10
				Prairie junegrass	10
				Sideoats grama	10
				Sand bluestem	5
				Sand dropseed	5
				Western wheatgrass	5
				Fringed sagebrush	5
Cushman	Loamy Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Blue grama	25
		Unfavorable	800	Prairie junegrass	15
				Needlegrass	10
				Sideoats grama	10
				Sedge	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
8*:					
Bresser	Sandy Foothills	Favorable	1,800	Prairie sandreed	20
		Normal	1,500	Blue grama	15
		Unfavorable	1,000	Needleandthread	10
				Little bluestem	10
				Prairie junegrass	10
				Sideoats grama	10
				Sand bluestem	5
				Sand dropseed	5
				Western wheatgrass	5
				Fringed sagebrush	5
Stapleton	Sandy Foothills	Favorable	1,500	Blue grama	20
		Normal	1,000	Prairie sandreed	20
		Unfavorable	800	Little bluestem	10
				Sideoats grama	10
				Western wheatgrass	10
				Needleandthread	5
				Mountain muhly	5
				Thickspike wheatgrass	5
				Sedge	5
				Prairie junegrass	5
9*:					
Bresser	Sandy Foothills	Favorable	1,800	Prairie sandreed	20
		Normal	1,500	Blue grama	15
		Unfavorable	1,000	Needleandthread	10
				Little bluestem	10
				Prairie junegrass	10
				Sideoats grama	10
				Sand bluestem	5
				Sand dropseed	5
				Western wheatgrass	5
				Fringed sagebrush	5
Truckton	Sandy Foothills	Favorable	1,500	Blue grama	20
		Normal	1,200	Prairie sandreed	20
		Unfavorable	800	Needleandthread	10
				Sand dropseed	10
				Sideoats grama	10
				Western wheatgrass	5
				Sedge	5
				Sand sagebrush	5
10, 11 Brussett	Loamy Park	Favorable	2,000	Mountain muhly	20
		Normal	1,400	Arizona fescue	15
		Unfavorable	1,000	Prairie junegrass	10
				Western wheatgrass	10
				Needlegrass	10
				Bluegrass	5
				Parry oatgrass	5
				Little bluestem	5
				Nodding bromegrass	5
				Elk sedge	5
12 Coni	Loamy Park	Favorable	1,800	Arizona fescue	15
		Normal	1,500	Mountain muhly	15
		Unfavorable	1,200	Western wheatgrass	15
				Bluegrass	10
				Parry oatgrass	10
				Blue grama	5
				Little bluestem	5
				Needlegrass	5
				Prairie junegrass	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
13 Cushman	Loamy Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Blue grama	25
		Unfavorable	800	Prairie junegrass	15
				Needlegrass	10
				Sideoats grama	10
				Sedge	5
14*:					
Cushman	Loamy Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Blue grama	25
		Unfavorable	800	Prairie junegrass	15
				Needlegrass	10
				Sideoats grama	10
				Sedge	5
Ascalon	Sandy Foothills	Favorable	2,000	Prairie sandreed	20
		Normal	1,400	Blue grama	15
		Unfavorable	800	Needleandthread	15
				Sideoats grama	15
				Little bluestem	15
				Sand bluestem	5
				Big bluestem	5
				Sand sagebrush	5
15*:					
Cushman	Loamy Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Blue grama	25
		Unfavorable	800	Prairie junegrass	15
				Needlegrass	10
				Sideoats grama	10
				Sedge	5
Hargreave	Cobbly Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Needleandthread	15
		Unfavorable	800	Blue grama	10
				Little bluestem	10
				Sideoats grama	10
				Prairie junegrass	5
				Fringed sagewort	5
16*:					
Cushman	Loamy Foothills	Favorable	1,700	Western wheatgrass	35
		Normal	1,200	Blue grama	25
		Unfavorable	800	Prairie junegrass	15
				Needlegrass	10
				Sideoats grama	10
				Sedge	5
Kutch	Clayey Foothills	Favorable	1,200	Western wheatgrass	50
		Normal	900	Green needlegrass	10
		Unfavorable	600	Blue grama	10
				Fourwing saltbush	10
				Sideoats grama	5
19 Ellicott	Sandy Bottomland	Favorable	1,500	Switchgrass	30
		Normal	1,200	Sand dropseed	15
		Unfavorable	800	Prairie sandreed	10
				Sand bluestem	10
				Sand sagebrush	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
20 Englewood	Clayey Foothills	Favorable	1,500	Western wheatgrass	40
		Normal	1,200	Blue grama	15
		Unfavorable	700	Green needlegrass	10
				Fourwing saltbush	10
				Little bluestem	5
				Sedge	5
				Bluegrass	5
				Indian ricegrass	5
24 Heldt	Clayey Foothills	Favorable	1,500	Western wheatgrass	45
		Normal	1,200	Green needlegrass	10
		Unfavorable	500	Indian ricegrass	10
				Blue grama	10
				Fourwing saltbush	10
				Prairie junegrass	5
				Bluegrass	5
25, 26 Holderness	Loamy Park	Favorable	2,000	Mountain muhly	20
		Normal	1,200	Wheatgrass	15
		Unfavorable	900	Arizona fescue	15
				Prairie junegrass	8
				Blue grama	5
				Needleandthread	5
				Bluegrass	5
				Elk sedge	5
				Mountain brome	5
29, 30 Kutch	Clayey Foothills	Favorable	1,200	Western wheatgrass	50
		Normal	900	Green needlegrass	10
		Unfavorable	600	Blue grama	10
				Fourwing saltbush	10
				Sideoats grama	5
31*:					
Kutch	Clayey Foothills	Favorable	1,200	Western wheatgrass	50
		Normal	900	Green needlegrass	10
		Unfavorable	600	Blue grama	10
				Fourwing saltbush	10
				Sideoats grama	5
Louviers	Shaly Foothills	Favorable	800	Western wheatgrass	25
		Normal	700	Sideoats grama	10
		Unfavorable	500	Little bluestem	10
				Blue grama	10
				Needleandthread	10
				Green needlegrass	5
				Spike muhly	5
				Winterfat	5
32, 33 Nunn	Clayey Foothills	Favorable	1,300	Western wheatgrass	40
		Normal	950	Blue grama	15
		Unfavorable	800	Buffalograss	10
				Fourwing saltbush	10
				Needlegrass	10
				Indian ricegrass	10
34 Peyton	Sandy Divide	Favorable	2,500	Mountain muhly	25
		Normal	1,500	Sand bluestem	10
		Unfavorable	900	Little bluestem	10
				Prairie sandreed	10
				Blue grama	10
				Prairie junegrass	10
				Western wheatgrass	10

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
35*:					
Peyton	Sandy Divide	Favorable	2,500	Mountain muhly	25
		Normal	1,500	Sand bluestem	10
		Unfavorable	900	Little bluestem	10
				Prairie sandreed	10
				Blue grama	10
				Prairie junegrass	10
				Western wheatgrass	10
Elbeth.					
36*:					
Peyton	Sandy Divide	Favorable	2,500	Mountain muhly	25
		Normal	1,500	Sand bluestem	10
		Unfavorable	900	Little bluestem	10
				Prairie sandreed	10
				Blue grama	10
				Prairie junegrass	10
				Western wheatgrass	10
Pring	Loamy Park	Favorable	1,800	Mountain muhly	25
		Normal	1,600	Arizona fescue	20
		Unfavorable	1,200	Needlegrass	10
				Bluegrass	10
				Parry oatgrass	10
				Blue grama	10
				Prairie junegrass	5
				Gambel oak	5
37 Pring	Loamy Park	Favorable	1,800	Mountain muhly	25
		Normal	1,600	Arizona fescue	20
		Unfavorable	1,200	Needlegrass	10
				Bluegrass	10
				Parry oatgrass	10
				Blue grama	10
				Prairie junegrass	5
				Gambel oak	5
38 Renohill	Clayey Foothills	Favorable	1,400	Western wheatgrass	40
		Normal	1,100	Green needlegrass	15
		Unfavorable	750	Blue grama	15
				Big sagebrush	10
				Cusick bluegrass	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Thickspike wheatgrass	5
39*:					
Renohill	Clayey Foothills	Favorable	1,400	Western wheatgrass	40
		Normal	1,100	Green needlegrass	15
		Unfavorable	750	Blue grama	15
				Big sagebrush	10
				Cusick bluegrass	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Thickspike wheatgrass	5
Louviers	Shaly Foothills	Favorable	800	Western wheatgrass	25
		Normal	700	Sideoats grama	10
		Unfavorable	500	Little bluestem	10
				Blue grama	10
				Needleandthread	10
				Green needlegrass	5
				Spike muhly	5
				Winterfat	5

See footnote at end of table.

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
41: Truckton	Sandy Foothills	Favorable	1,500	Blue grama	20
		Normal	1,200	Prairie sandreed	20
		Unfavorable	800	Needleandthread	10
				Sand dropseed	10
				Sideoats grama	10
				Western wheatgrass	5
				Sedge	5
				Sand sagebrush	5
42*:					
Truckton	Sandy Foothills	Favorable	1,500	Blue grama	20
		Normal	1,200	Prairie sandreed	20
		Unfavorable	800	Needleandthread	10
				Sand dropseed	10
				Sideoats grama	10
				Western wheatgrass	5
				Sedge	5
				Sand sagebrush	5
Renohill	Clayey Foothills	Favorable	1,800	Western wheatgrass	40
		Normal	1,300	Green needlegrass	15
		Unfavorable	750	Blue grama	15
				Big sagebrush	10
				Cusick bluegrass	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Thickspike wheatgrass	5
43, 44: Weld	Loamy Foothills	Favorable	1,600	Western wheatgrass	35
		Normal	1,000	Blue grama	25
		Unfavorable	800	Sideoats grama	10
				Prairie junegrass	10
				Needleandthread	5
				Sedge	5
45*:					
Wiley	Loamy Foothills	Favorable	1,600	Western wheatgrass	35
		Normal	1,100	Blue grama	25
		Unfavorable	800	Green needlegrass	10
				Sideoats grama	10
				Prairie junegrass	10
Baca	Loamy Foothills	Favorable	1,600	Western wheatgrass	35
		Normal	1,100	Blue grama	25
		Unfavorable	800	Prairie junegrass	10
				Green needlegrass	10
				Sideoats grama	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
17------------------ Elbeth	6o	Slight	Slight	Slight	Slight	Ponderosa pine------	52	Ponderosa pine, Douglas-fir, white fir, blue spruce.
18*:								
Elbeth------------	6o	Slight	Slight	Slight	Slight	Ponderosa pine------	52	Ponderosa pine, Douglas-fir, white fir, blue spruce.
Kettle------------	5o	Slight	Slight	Slight	Slight	Ponderosa pine------	62	Ponderosa pine, Douglas-fir, white fir.
27------------------ Kettle	5o	Slight	Slight	Slight	Slight	Ponderosa pine------	62	Ponderosa pine, Douglas-fir, white fir.
28*:								
Kettle------------	5o	Slight	Slight	Slight	Slight	Ponderosa pine------	62	Ponderosa pine, Douglas-fir, white fir.
Rock outcrop.								
35*:								
Peyton.								
Elbeth------------	6o	Slight	Slight	Slight	Slight	Ponderosa pine------	52	Ponderosa pine, Douglas-fir, white fir, blue spruce.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Ascalon	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
2 Ascalon	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
3*:					
Baca	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wiley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
4*:					
Bluerim	Moderate: depth to rock, slope.	Moderate: slope.	Severe: depth to rock.	Severe: slope.	Moderate: slope.
Peyton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
5 Bresser	Slight	Slight	Slight	Slight	Moderate: frost action.
6 Bresser	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
7*:					
Bresser	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Cushman	Moderate: depth to rock, slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, depth to rock, shrink-swell.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
8*:					
Bresser	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Stapleton	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
9*:					
Bresser	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Truckton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
10 Brussett	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.
11 Brussett	Slight	Moderate: shrink-swell.	Slight	Moderate: slope, shrink-swell.	Moderate: low strength, frost action, shrink-swell.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
12 Coni	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
13 Cushman	Moderate: depth to rock.	Moderate: low strength, shrink-swell.	Moderate: depth to rock, low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
14*: Cushman	Moderate: depth to rock, slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, depth to rock, shrink-swell.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
Ascalon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
15*: Cushman	Moderate: depth to rock, slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, depth to rock, shrink-swell.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
Hargreave	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, frost action, shrink-swell.
16*: Cushman	Moderate: depth to rock, slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, depth to rock, shrink-swell.	Severe: slope.	Moderate: slope, low strength, shrink-swell.
Kutch	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope, low strength.
17 Elbeth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action, low strength.
18*: Elbeth	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kettle	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
19 Ellicott	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
20 Englewood	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
21*. Fluvaquents					
22*, 23*. Haplustolls					

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
24: Heldt	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
25, 26: Holderness	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
27: Kettle	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
28*:					
Kettle	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
29, 30: Kutch	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
31*:					
Kutch	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope, low strength.
Louviers	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, low strength, shrink-swell.
32, 33: Nunn	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
34: Peyton	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
35*:					
Peyton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Elbeth	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36*:					
Peyton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pring	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37: Pring	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
38: Renohill	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
39*:					
Renohill	Moderate: slope, depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
39*:					
Louviers	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, shrink-swell, slope.
40*:					
Torriorthents.					
Rock outcrop.					
41 Truckton	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
42*:					
Truckton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Renohill	Moderate: slope, depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
43 Weld	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell, frost action.
44 Weld	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell, frost action.
45*:					
Wiley	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Baca	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1, 2 Ascalon	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
3*:					
Baca	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Wiley	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
4*:					
Bluerim	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: thin layer, area reclaim, slope.
Peyton	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
5, 6 Bresser	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
7*:					
Bresser	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
8*:					
Bresser	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Stapleton	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
9*:					
Bresser	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Truckton	Severe: slope poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
10, 11 Brussett	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
12 Coni	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
13 Cushman	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14*:					
Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Ascalon	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
15*:					
Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Hargreave	Severe: depth to rock.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, small stones, thin layer.
16*:					
Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Kutch	Severe: depth to rock, percs slowly, slope.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope, area reclaim.
17 Elbeth	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
18*:					
Elbeth	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Kettle	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
19 Ellicott	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: too sandy, seepage.
20 Englewood	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
21*. Fluvaquents					
22*, 23*. Haplustolls					
24 Heldt	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
25, 26 Holderness	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
27 Kettle	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
28*:					
Kettle	Severe: slope.	Severe: seepage, slope.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
Rock outcrop.					
29, 30 Kutch	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey, area reclaim, thin layer.
31*:					
Kutch	Severe: depth to rock, percs slowly, slope.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope, area reclaim.
Louviers	Severe: percs slowly, depth to rock, slope.	Severe: depth to rock, slope.	Severe: too clayey, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
32, 33 Nunn	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
34 Peyton	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
35*:					
Peyton	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Elbeth	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
36*:					
Peyton	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope.	Poor: slope.
Pring	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, seepage.
37 Pring	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
38 Renohill	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: area reclaim, thin layer.
39*:					
Renohill	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: area reclaim, thin layer.
Louviers	Severe: percs slowly, depth to rock, slope.	Severe: depth to rock, slope.	Severe: too clayey, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
40*:					
Torriorthents.					
Rock outcrop.					

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
41: Truckton	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
42*:					
Truckton	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
Renohill	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: area reclaim, thin layer.
43, 44: Weld	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
45*:					
Wiley	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Baca	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2------------------ Ascalon	Poor: low strength.	Poor: excess fines.	Unsuited-------------	Fair: too clayey.
3*:				
Baca------------------	Poor: low strength.	Unsuited-------------	Unsuited-------------	Fair: too clayey.
Wiley-----------------	Poor: low strength.	Unsuited-------------	Unsuited-------------	Fair: too clayey.
4*:				
Bluerim---------------	Poor: thin layer, area reclaim.	Unsuited: thin layer.	Unsuited: thin layer, excess fines.	Fair: too clayey, small stones, slope.
Peyton----------------	Good-----------------	Poor: excess fines.	Unsuited-------------	Fair: small stones.
5, 6------------------ Bresser	Good-----------------	Poor: excess fines.	Unsuited-------------	Fair: small stones, too clayey.
7*:				
Bresser---------------	Good-----------------	Poor: excess fines.	Unsuited-------------	Fair: slope, too clayey, small stones.
Cushman---------------	Poor: area reclaim, thin layer.	Unsuited-------------	Unsuited-------------	Fair: too clayey, slope, thin layer.
8*:				
Bresser---------------	Good-----------------	Poor: excess fines.	Unsuited-------------	Fair: slope, too clayey, small stones.
Stapleton-------------	Fair: slope.	Unsuited-------------	Unsuited-------------	Poor: slope.
9*:				
Bresser---------------	Good-----------------	Poor: excess fines.	Unsuited-------------	Fair: slope, too clayey, small stones.
Truckton--------------	Fair: slope.	Poor: excess fines.	Unsuited-------------	Poor: slope.
10, 11---------------- Brussett	Fair: low strength.	Unsuited-------------	Unsuited-------------	Fair: too clayey.
12-------------------- Coni	Poor: area reclaim, thin layer.	Unsuited-------------	Unsuited-------------	Poor: thin layer, area reclaim.
13-------------------- Cushman	Poor: area reclaim, thin layer.	Unsuited-------------	Unsuited-------------	Fair: too clayey, thin layer, area reclaim.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
14*:				
Cushman	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Fair: too clayey, slope, thin layer.
Ascalon	Poor: low strength.	Poor: excess fines.	Unsuited	Fair: slope, too clayey.
15*:				
Cushman	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Fair: too clayey, slope, thin layer.
Hargreave	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: large stones.
16*:				
Cushman	Poor: area reclaim, thin layer.	Unsuited	Unsuited	Fair: too clayey, slope, thin layer.
Kutch	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Poor: slope, too clayey.
17 Elbeth	Fair: shrink-swell, low strength, frost action.	Unsuited	Unsuited	Fair: small stones.
18*:				
Elbeth	Fair: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
Kettle	Fair: slope.	Poor: excess fines.	Unsuited	Fair: too sandy, slope.
19 Ellicott	Good	Fair: excess fines.	Unsuited	Poor: too sandy.
20 Englewood	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
21*. Fluvaquents				
22*, 23*. Haplustolls				
24 Heldt	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
25, 26 Holderness	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
27 Kettle	Good	Poor: excess fines.	Unsuited	Fair: too sandy.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
28*: Kettle	Poor: slope.	Poor: excess fines.	Unsuited	Fair: too sandy, slope.
Rock outcrop.				
29, 30 Kutch	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Poor: too clayey.
31*: Kutch	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Poor: slope, too clayey.
Louviers	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Poor: too clayey, slope, area reclaim.
32, 33 Nunn	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
34 Peyton	Good	Poor: excess fines.	Unsuited	Fair: small stones.
35*: Peyton	Good	Poor: excess fines.	Unsuited	Fair: small stones.
Elbeth	Fair: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
36*: Peyton	Fair: slope.	Poor: excess fines.	Unsuited	Poor: slope.
Pring	Fair: slope.	Poor: excess fines.	Poor: excess fines.	Poor: slope.
37 Pring	Good	Poor: excess fines.	Poor: excess fines.	Fair: small stones.
38 Renohill	Poor: low strength, thin layer, area reclaim.	Unsuited	Unsuited	Fair: thin layer, too clayey, area reclaim.
39*: Renohill	Poor: low strength, thin layer, area reclaim.	Unsuited	Unsuited	Fair: thin layer, area reclaim, too clayey.
Louviers	Poor: low strength, shrink-swell, thin layer.	Unsuited	Unsuited	Poor: too clayey, slope, area reclaim.
40*: Torriorthents.				

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
40*:				
Rock outcrop.				
41 Truckton	Good	Poor: excess fines.	Unsuited	Good.
42*:				
Truckton	Fair: slope.	Poor: excess fines.	Unsuited	Poor: slope.
Renohill	Poor: low strength, thin layer, area reclaim.	Unsuited	Unsuited	Fair: thin layer, area reclaim, too clayey.
43, 44 Weld	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
45*:				
Wiley	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
Baca	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1------------------ Ascalon	Seepage, slope.	Piping----------	Slope-----------	Slope-----------	Favorable-------	Favorable.
2------------------ Ascalon	Seepage, slope.	Piping----------	Slope-----------	Slope-----------	Slope-----------	Slope.
3*:						
Baca--------------	Favorable-------	Favorable-------	Favorable-------	Favorable-------	Favorable-------	Favorable.
Wiley-------------	Seepage---------	Favorable-------	Favorable-------	Erodes easily	Favorable-------	Erodes easily.
4*:						
Bluerim-----------	Slope, depth to rock, seepage.	Thin layer, low strength.	Slope, depth to rock.	Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.
Peyton------------	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing.	Soil blowing----	Slope.
5------------------ Bresser	Seepage---------	Favorable-------	Favorable-------	Soil blowing----	Soil blowing----	Favorable.
6------------------ Bresser	Seepage, slope.	Favorable-------	Slope-----------	Slope, soil blowing.	Soil blowing----	Favorable.
7*:						
Bresser-----------	Seepage, slope.	Favorable-------	Slope-----------	Slope, soil blowing.	Slope, soil blowing.	Slope.
Cushman-----------	Depth to rock, slope, seepage.	Thin layer------	Depth to rock, complex slope.	Rooting depth, complex slope.	Slope, depth to rock.	Rooting depth, slope.
8*:						
Bresser-----------	Seepage, slope.	Favorable-------	Slope-----------	Slope, soil blowing.	Slope, soil blowing.	Slope.
Stapleton---------	Slope, seepage.	Favorable-------	Slope-----------	Slope, droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
9*:						
Bresser-----------	Seepage, slope.	Favorable-------	Slope-----------	Slope, soil blowing.	Slope, soil blowing.	Slope.
Truckton----------	Slope, seepage.	Favorable-------	Slope-----------	Droughty, soil blowing.	Slope, soil blowing.	Slope, soil blowing, droughty.
10----------------- Brussett	Seepage---------	Piping----------	Favorable-------	Favorable-------	Favorable-------	Favorable.
11----------------- Brussett	Slope, seepage.	Piping----------	Slope-----------	Slope-----------	Favorable-------	Favorable.
12----------------- Coni	Slope, depth to rock.	Thin layer------	Slope, depth to rock.	Slope, rooting depth, droughty.	Depth to rock, slope.	Slope, droughty, rooting depth.
13----------------- Cushman	Depth to rock, slope, seepage.	Thin layer------	Depth to rock, complex slope.	Rooting depth, complex slope.	Depth to rock	Rooting depth.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
14*						
Cushman	Depth to rock, slope, seepage.	Thin layer	Depth to rock, complex slope.	Rooting depth, complex slope.	Slope, depth to rock.	Rooting depth, slope.
Ascalon	Seepage, slope.	Piping	Slope	Slope	Slope	Slope.
15*:						
Cushman	Depth to rock, slope, seepage.	Thin layer	Depth to rock, complex slope.	Rooting depth, complex slope.	Slope, depth to rock.	Rooting depth, slope.
Hargreave	Slope, seepage.	Thin layer, low strength.	Slope, depth to rock.	Slope, large stones, rooting depth.	Large stones, slope, depth to rock.	Slope, large stones, rooting depth.
16*:						
Cushman	Depth to rock, slope, seepage.	Thin layer	Depth to rock, complex slope.	Rooting depth, complex slope.	Slope, depth to rock.	Rooting depth, slope.
Kutch	Depth to rock, slope.	Thin layer, hard to pack.	Depth to rock, percs slowly, slope.	Rooting depth, percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope, rooting depth.
17 Elbeth	Seepage, slope.	Favorable	Slope	Slope, soil blowing.	Soil blowing	Favorable.
18*:						
Elbeth	Seepage, slope.	Favorable	Slope	Slope, soil blowing.	Slope, soil blowing.	Slope.
Kettle	Slope, seepage.	Favorable	Slope, soil blowing.	Slope, soil blowing.	Slope, soil blowing.	Slope.
19 Ellicott	Seepage	Piping, seepage.	Floods, cutbanks cave.	Floods, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
20 Englewood	Favorable	Hard to pack	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
21*. Fluvaquents						
22*, 23*. Haplustolls						
24 Heldt	Slope	Hard to pack	Percs slowly, slope.	Slope, percs slowly.	Percs slowly	Percs slowly.
25 Holderness	Favorable	Hard to pack	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
26 Holderness	Slope	Hard to pack	Slope, percs slowly.	Slope, percs slowly.	Percs slowly, slope.	Slope, percs slowly.
27 Kettle	Slope, seepage.	Favorable	Slope, soil blowing.	Slope, soil blowing.	Soil blowing	Slope.
28*:						
Kettle	Slope, seepage.	Favorable	Slope, soil blowing.	Slope, soil blowing.	Slope, soil blowing.	Slope.
Rock outcrop.						

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
29----------------- Kutch	Depth to rock	Thin layer, hard to pack.	Depth to rock, percs slowly.	Rooting depth, percs slowly.	Percs slowly, depth to rock.	Percs slowly, rooting depth.
30----------------- Kutch	Depth to rock, slope.	Thin layer, hard to pack.	Depth to rock, percs slowly, slope.	Rooting depth, percs slowly, slope.	Percs slowly, depth to rock.	Percs slowly, rooting depth.
31*:						
Kutch-------------	Depth to rock, slope.	Thin layer, hard to pack.	Depth to rock, percs slowly, slope.	Rooting depth, percs slowly, slope.	Percs slowly, slope, depth to rock.	Percs slowly, slope, rooting depth.
Louviers----------	Slope, depth to rock.	Thin layer, hard to pack.	Slope, depth to rock, percs slowly.	Rooting depth, slow intake, slope.	Depth to rock, percs slowly.	Slope, rooting depth, percs slowly.
32----------------- Nunn	Favorable-------	Hard to pack---	Percs slowly, slope.	Percs slowly, slope, slow intake.	Percs slowly---	Percs slowly.
33----------------- Nunn	Slope-----------	Hard to pack---	Percs slowly, slope.	Percs slowly, slope, slow intake.	Percs slowly, slope.	Slope, percs slowly.
34----------------- Peyton	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing.	Soil blowing---	Favorable.
35*:						
Peyton------------	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing.	Soil blowing---	Slope.
Elbeth------------	Seepage, slope.	Favorable-------	Slope-----------	Slope, soil blowing.	Slope, soil blowing.	Slope.
36*:						
Peyton------------	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing.	Soil blowing---	Slope.
Pring-------------	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing, droughty.	Slope, soil blowing.	Slope, droughty.
37----------------- Pring	Slope, seepage.	Favorable-------	Slope-----------	Slope, soil blowing, droughty.	Soil blowing---	Droughty.
38----------------- Renohill	Slope, depth to rock.	Low strength, thin layer, compressible.	Slope, depth to rock, percs slowly.	Slope, rooting depth, slow intake.	Depth to rock, percs slowly.	Rooting depth, percs slowly.
39*:						
Renohill----------	Slope, depth to rock.	Low strength, thin layer, compressible.	Slope, depth to rock, percs slowly.	Slope, rooting depth, slow intake.	Slope, depth to rock, percs slowly.	Slope, rooting depth, percs slowly.
Louviers----------	Slope, depth to rock.	Thin layer, hard to pack.	Slope, depth to rock, percs slowly.	Rooting depth, slow intake, slope.	Slope, depth to rock, percs slowly.	Slope, rooting depth, percs slowly.
40*:						
Torriorthents.						
Rock outcrop.						
41----------------- Truckton	Slope, seepage.	Favorable-------	Slope-----------	Droughty, soil blowing.	Soil blowing---	Soil blowing, droughty.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
42*:						
Truckton	Slope, seepage.	Favorable	Slope	Droughty, soil blowing.	Slope, soil blowing.	Slope, soil blowing, droughty.
Renohill	Slope, depth to rock.	Low strength, thin layer, compressible.	Slope, depth to rock, percs slowly.	Slope, rooting depth, slow intake.	Slope, depth to rock, percs slowly.	Slope, rooting depth, percs slowly.
43, 44 Weld	Seepage	Favorable	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
45*:						
Wiley	Slope, seepage.	Favorable	Slope	Slope, erodes easily.	Favorable	Erodes easily.
Baca	Slope	Favorable	Favorable	Slope	Favorable	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Ascalon	Slight	Slight	Moderate: slope.	Slight.
2 Ascalon	Slight	Slight	Severe: slope.	Slight.
3*:				
Baca	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Wiley	Slight	Slight	Moderate: slope.	Slight.
4*:				
Bluerim	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Peyton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
5 Bresser	Slight	Slight	Moderate: slope.	Slight.
6 Bresser	Slight	Slight	Severe: slope.	Slight.
7*:				
Bresser	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cushman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
8*:				
Bresser	Severe: slope.	Severe: slope.	Severe: slope.	Slight.
Stapleton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
9*:				
Bresser	Severe: slope.	Severe: slope.	Severe: slope.	Slight.
Truckton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
10 Brussett	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
11 Brussett	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
12 Coni	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
13 Cushman	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
14*:				
Cushman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Ascalon	Moderate: slope.	Moderate: too sandy, slope.	Severe: slope.	Slight.
15*:				
Cushman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Hargreave	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones, small stones.	Moderate: large stones.
16*:				
Cushman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Kutch	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
17 Elbeth	Slight	Slight	Severe: slope.	Slight.
18*:				
Elbeth	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Kettle	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
19 Ellicott	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.	Moderate: too sandy, floods.
20 Englewood	Slight	Slight	Moderate: slope, too clayey.	Slight.
21*. Fluvaquents				
22*, 23*. Haplustolls				
24 Heldt	Slight	Slight	Moderate: slope, too clayey, percs slowly.	Slight.
25 Holderness	Slight	Slight	Moderate: slope.	Slight.
26 Holderness	Slight	Slight	Severe: slope.	Slight.
27 Kettle	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
28*:				
Kettle	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
29 Kutch	Slight	Slight	Moderate: slope, too clayey.	Slight.
30 Kutch	Slight	Slight	Severe: slope.	Slight.
31*:				
Kutch	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
Louviers	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock, slope.	Severe: slope.
32 Nunn	Slight	Slight	Moderate: slope, too clayey.	Slight.
33 Nunn	Slight	Slight	Severe: slope.	Slight.
34 Peyton	Slight	Slight	Severe: slope.	Slight.
35*:				
Peyton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Elbeth	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
36*:				
Peyton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Pring	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
37 Pring	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
38 Renohill	Slight	Slight	Severe: slope.	Slight.
39*:				
Renohill	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Louviers	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock, slope.	Severe: slope.
40*:				
Torriorthents.				

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
40*:				
Rock outcrop.				
41 Truckton	Slight	Slight	Severe: slope.	Slight.
42*:				
Truckton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Renohill	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
43, 44 Weld	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
45*:				
Wiley	Slight	Slight	Severe: slope.	Slight.
Baca	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1-----Ascalon	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
2-----Ascalon	Poor	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
3*:											
Baca-----	Poor	Good	Fair	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor
Wiley-----	Poor	Fair	Fair	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor
4*:											
Bluerim-----	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
Peyton-----	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
5-----Bresser	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
6-----Bresser	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
7*:											
Bresser-----	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
Cushman-----	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
8*:											
Bresser-----	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
Stapleton	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
9*:											
Bresser-----	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
Truckton-----	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
10, 11-----Brussett	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
12-----Coni	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
13-----Cushman	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
14*:											
Cushman-----	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Ascalon-----	Poor	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
15*:											
Cushman	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Hargreave	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
16*:											
Cushman	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Kutch	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
17 Elbeth	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor	Good
18*:											
Elbeth	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor	Good
Kettle	Poor	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Fair	Very poor	Good
19 Ellicott	Very poor	Very poor	Poor	---	Fair	Poor	Very poor	Very poor	---	Very poor	Fair
20 Englewood	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
21*. Fluvaquents											
22*, 23*. Haplustolls											
24 Heldt	Fair	Fair	Poor	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor
25, 26 Holderness	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
27 Kettle	Poor	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Fair	Very poor	Good
28*:											
Kettle	Poor	Fair	Good	Fair	Good	Very poor	Very poor	Fair	Fair	Very poor	Good
Rock outcrop.											
29, 30 Kutch	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
31*:											
Kutch	Poor	Poor	Fair	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
Louviers	Poor	Poor	Poor	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
32, 33 Nunn	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
34 Peyton	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- libe	Range- land wild- hife
35*:											
Peyton	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Elbeth	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor	Good
36*:											
Peyton	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Pring	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
37 Pring	Fair	Fair	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
38 Renohill	Fair	Good	Fair	---	Fair	Poor	Very poor	Fair	---	Very poor	Fair
39*:											
Renohill	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Louviers	Poor	Poor	Poor	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
40*:											
Torriorthents.											
Rock outcrop*.											
41 Truckton	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
42*:											
Truckton	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Renohill	Poor	Fair	Fair	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
43, 44 Weld	Fair	Fair	Fair	---	Poor	Poor	Very poor	Fair	---	Very	Poor
45*:											
Wiley	Poor	Fair	Fair	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor
Baca	Poor	Good	Fair	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor

*See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1, 2----------------- Ascalon	0-4	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	4-22	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	22-45	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-65	20-40	5-15
	45-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
3*: Baca---------------	0-4	Loam-------------	CL-ML	A-4	0	100	100	85-95	70-90	20-30	5-10
	4-18	Silty clay loam, clay loam, clay.	CL	A-7, A-6	0	100	100	90-100	75-95	35-50	15-30
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	70-90	25-40	5-15
Wiley--------------	0-3	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	3-29	Silty clay loam, silt loam, clay loam.	CL	A-6	0	100	100	90-100	70-95	25-35	10-20
	29-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	80-95	25-35	5-15
4*: Bluerim------------	0-5	Sandy loam-------	SM	A-2	0	95-100	75-90	50-70	25-35	20-30	NP-5
	5-31	Sandy clay loam	SM	A-2, A-4	0	95-100	75-90	60-75	30-40	25-35	5-10
	31	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Peyton-------------	0-3	Sandy loam-------	SC	A-2	0	95-100	75-100	35-50	20-35	30-40	10-20
	3-32	Sandy clay loam, clay loam, loam.	SC, CL	A-2, A-6, A-7	0	95-100	75-100	55-70	30-60	35-50	15-25
	32-60	Loamy coarse sand, sandy loam, very gravelly sandy loam.	SC, SM-SC	A-2	0-5	80-100	35-85	20-50	10-35	20-35	5-15
5, 6----------------- Bresser	0-7	Sandy loam-------	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
	7-20	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	10-25
	20-29	Sandy loam, coarse sandy loam, gravelly sandy loam.	SC, SM-SC	A-2	0	90-100	75-100	30-60	20-30	25-35	5-15
	29-60	Loamy coarse sand, sandy loam, gravelly loamy sand.	SP-SC	A-2	0-5	80-100	50-85	20-50	5-10	20-30	5-10

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
7*:											
Bresser	0-7	Sandy loam	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
	7-20	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	10-25
	20-29	Sandy loam, coarse sandy loam, gravelly sandy loam.	SC, SM-SC	A-2	0	90-100	75-100	30-60	20-30	25-35	5-15
	29-60	Loamy coarse sand, sandy loam, gravelly loamy sand.	SP-SC	A-2	0-5	80-100	50-85	20-50	5-10	20-30	5-10
Cushman	0-4	Loam	ML, CL-ML	A-4	0	100	85-100	85-95	60-75	20-30	NP-10
	4-34	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	70-80	25-35	10-15
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
8*:											
Bresser	0-7	Sandy loam	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
	7-20	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	10-25
	20-29	Sandy loam, coarse sandy loam, gravelly sandy loam.	SC, SM-SC	A-2	0	90-100	75-100	30-60	20-30	25-35	5-15
	29-60	Loamy coarse sand, sandy loam, gravelly loamy sand.	SP-SC	A-2	0-5	80-100	50-85	20-50	5-10	20-30	5-10
Stapleton	0-37	Sandy loam	SM-SC	A-2, A-4	0-5	85-100	75-95	35-50	30-40	15-25	5-10
	37-60	Loamy coarse sand, loamy sand, gravelly loamy sand.	SP-SM, SM	A-1	0-5	70-90	60-80	25-35	5-15	15-20	NP-5
9*:											
Bresser	0-7	Sandy loam	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
	7-20	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	10-25
	20-29	Sandy loam, coarse sandy loam, gravelly sandy loam.	SC, SM-SC	A-2	0	90-100	75-100	30-60	20-30	25-35	5-15
	29-60	Loamy coarse sand, sandy loam, gravelly loamy sand.	SP-SC	A-2	0-5	80-100	50-85	20-50	5-10	20-30	5-10
Truckton	0-5	Sandy loam	SM-SC	A-2	0	95-100	90-100	50-75	25-35	20-30	5-10
	5-15	Sandy loam	SC, SM-SC	A-2, A-4, A-6	0	95-100	95-100	60-70	30-40	20-40	5-20
	15-60	Sandy loam, loamy sand, loamy coarse sand.	SC, SM-SC	A-2	0	95-100	95-100	50-65	20-35	20-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
10, 11------------- Brussett	0-10	Loam------------	ML	A-4	0	100	95-100	85-95	60-85	30-40	5-10
	10-29	Clay loam, loam	CL	A-6, A-7	0	100	95-100	95-100	80-90	30-50	10-25
	29-60	Loam, silt loam	ML	A-4	0	100	95-100	90-95	60-75	30-40	5-10
12----------------- Coni	0-9	Loam------------	ML	A-4	0-5	95-100	75-100	70-90	60-75	20-35	NP-10
	9-19	Clay loam, loam	CL	A-6	0-5	75-100	75-100	60-90	50-70	25-40	10-25
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
13----------------- Cushman	0-4	Loam------------	ML, CL-ML	A-4	0	100	85-100	85-95	60-75	20-30	NP-10
	4-34	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	70-80	25-35	10-15
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
14*:											
Cushman-----------	0-4	Loam------------	ML, CL-ML	A-4	0	100	85-100	85-95	60-75	20-30	NP-10
	4-34	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	70-80	25-35	10-15
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Ascalon-----------	0-4	Sandy loam------	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	4-22	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	22-45	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-65	20-40	5-15
	45-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
15*:											
Cushman-----------	0-4	Loam------------	ML, CL-ML	A-4	0	100	85-100	85-95	60-75	20-30	NP-10
	4-34	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	70-80	25-35	10-15
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Hargreave---------	0-5	Cobbly sandy loam.	SM	A-2, A-4	25-50	75-100	75-90	50-70	25-40	---	NP
	5-14	Sandy clay loam, gravelly sandy clay loam.	SM-SC, SC	A-4, A-6	0-5	75-100	60-90	50-70	35-50	20-30	5-15
	14-24	Sandy loam------	SM	A-2, A-4	0-5	75-100	75-95	50-65	25-40	---	NP
	24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
16*:											
Cushman-----------	0-4	Loam------------	ML, CL-ML	A-4	0	100	85-100	85-95	60-75	20-30	NP-10
	4-34	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	70-80	25-35	10-15
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Kutch-------------	0-7	Clay loam-------	CL	A-6, A-7	0-10	95-100	90-100	90-100	70-80	30-50	15-30
	7-30	Clay, clay loam	CH, CL	A-7	0-5	95-100	90-100	90-100	75-95	45-60	20-35
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17----------------- Elbeth	0-13	Sandy loam------	SM, SM-SC	A-2, A-4, A-1	0	90-100	75-100	40-65	10-40	20-40	NP-10
	13-60	Sandy clay loam	SC, CL	A-6, A-2	0	90-100	75-100	40-65	30-55	30-40	10-20
18*:											
Elbeth------------	0-13	Sandy loam------	SM, SM-SC	A-2, A-4, A-1	0	90-100	75-100	40-65	10-40	20-40	NP-10
	13-60	Sandy clay loam	SC, CL	A-6, A-2	0	90-100	75-100	40-65	30-55	30-40	10-20
Kettle------------	0-22	Loamy sand------	---	---	---	75-90	75-90	45-65	10-20	---	NP
	22-53	Gravelly sandy loam, coarse sandy loam.	SC, SM-SC	A-2	0-5	85-100	50-85	25-50	15-30	25-35	5-15
	53-60	Very gravelly loamy sand, very gravelly sand, coarse sand.	SM-SC, SP, SP-SC	A-2, A-1	0-5	75-90	20-80	10-30	0-15	20-30	NP-10
19----------------- Ellicott	0-7	Loamy coarse sand.	SP-SM, SM	A-1	0	95-100	80-100	30-50	5-15	---	NP
	7-60	Stratified coarse sand to sandy loam.	SP-SM, SM	A-1	0-5	90-100	75-95	30-50	5-15	---	NP
20----------------- Englewood	0-4	Clay loam-------	CL	A-6, A-7	0	75-100	75-100	70-100	60-90	30-50	10-25
	4-40	Clay, clay loam-	CH, CL	A-7	0	85-100	85-100	70-100	60-90	40-70	20-40
	40-60	Clay loam, clay	CL, CH	A-6, A-7	0	75-100	75-100	70-100	60-90	30-60	10-35
21*. Fluvaquents											
22*, 23*. Haplustolls											
24----------------- Heldt	0-2	Clay loam-------	CH, CL	A-7	0	95-100	95-100	95-100	75-95	45-55	25-35
	2-60	Clay, silty clay loam, clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	45-55	25-35
25, 26------------- Holderness	0-4	Loam------------	ML	A-4	0-5	95-100	90-100	70-95	50-80	20-40	NP-10
	4-38	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	80-95	60-85	35-65	15-35
	38-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0-5	95-100	80-100	60-90	35-75	25-40	5-20
27----------------- Kettle	0-22	Loamy sand------	---	---	---	75-90	75-90	45-65	10-20	---	NP
	22-53	Gravelly sandy loam, coarse sandy loam.	SC, SM-SC	A-2	0-5	85-100	50-85	25-50	15-30	25-35	5-15
	53-60	Very gravelly loamy sand, very gravelly sand, coarse sand.	SM-SC, SP, SP-SC	A-2, A-1	0-5	75-90	20-80	10-30	0-15	20-30	NP-10

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
28*:											
Kettle-------------	0-22	Loamy sand-------	---	---	---	75-90	75-90	45-65	10-20	---	NP
	22-53	Gravelly sandy loam, coarse sandy loam.	SC, SM-SC	A-2	0-5	85-100	50-85	25-50	15-30	25-35	5-15
	53-60	Very gravelly loamy sand, very gravelly sand, coarse sand.	SM-SC, SP, SP-SC	A-2, A-1	0-5	75-90	20-80	10-30	0-15	20-30	NP-10
Rock outcrop.											
29, 30------------- Kutch	0-4	Clay loam--------	CL	A-6, A-7	0-10	95-100	90-100	90-100	70-80	30-50	15-30
	4-30	Clay, clay loam	CH, CL	A-7	0-5	95-100	90-100	90-100	75-95	45-60	20-35
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
31*:											
Kutch--------------	0-4	Clay loam--------	CL	A-6, A-7	0-10	95-100	90-100	90-100	70-80	30-50	15-30
	4-30	Clay, clay loam	CH, CL	A-7	0-5	95-100	90-100	90-100	75-95	45-60	20-35
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Louviers-----------	0-5	Clay-------------	CL, CH	A-7, A-6	0	90-100	80-100	80-100	75-95	35-55	15-30
	5-14	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	90-100	80-100	80-100	75-95	35-60	20-35
	14	Weathered bedrock.	---	---	---	---	---	---	---	---	---
32, 33------------- Nunn	0-8	Clay loam--------	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	80-95	70-95	45-75	20-40	5-20
	8-40	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	40-60	Stratified sandy loam to silty clay.	CL, CL-ML, SM-SC, SC	A-4, A-6	0-5	80-100	60-100	60-90	35-75	15-40	5-20
34----------------- Peyton	0-3	Sandy loam-------	SC	A-2	0	95-100	75-100	35-50	20-35	30-40	10-20
	3-32	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-7	0	95-100	75-100	55-70	40-60	35-50	15-25
	32-60	Loamy coarse sand, sandy loam, very gravelly sandy loam.	SC, SM-SC	A-2	0-5	80-100	35-85	20-50	10-35	20-35	5-15
35*:											
Peyton-------------	0-3	Sandy loam-------	SC	A-2	0	95-100	75-100	35-50	20-35	30-40	10-20
	3-32	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-7	0	95-100	75-100	55-70	40-60	35-50	15-25
	32-60	Loamy coarse sand, sandy loam, very gravelly sandy loam.	SC, SM-SC	A-2	0-5	80-100	35-85	20-50	10-35	20-35	5-15
Elbeth-------------	0-13	Sandy loam-------	SM, SM-SC	A-2, A-4, A-1	0	90-100	75-100	40-65	10-40	20-40	NP-10
	13-60	Sandy clay loam	SC, CL	A-6, A-2	0	90-100	75-100	40-65	30-55	30-40	10-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
36*:											
Peyton------------	0-3	Sandy loam------	SC	A-2	0	95-100	75-100	35-50	20-35	30-40	10-20
	3-32	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-7	0	95-100	75-100	55-70	40-60	35-50	15-25
	32-60	Loamy coarse sand, sandy loam, very gravelly sandy loam.	SC, SM-SC	A-2	0-5	80-100	35-85	20-50	10-35	20-35	5-15
Pring-------------	0-13	Coarse sandy loam.	SM-SC	A-2	0-5	85-100	75-90	45-60	15-30	15-25	5-10
	13-27	Coarse sandy loam, gravelly sandy loam.	SM-SC, SC	A-2	0-5	75-95	50-80	35-50	15-25	20-35	5-15
	27-60	Loamy coarse sand, loamy sand, gravelly loamy sand.	SP-SM, SM	A-1	0-5	70-90	60-80	25-35	5-15	15-20	NP-5
37----------------- Pring	0-13	Coarse sandy loam.	SM-SC	A-2	0-5	85-100	75-90	45-60	15-30	15-25	5-10
	13-27	Coarse sandy loam, gravelly sandy loam.	SM-SC, SC	A-2	0-5	75-95	50-80	35-50	15-25	20-35	5-15
	27-60	Loamy coarse sand, loamy sand, gravelly loamy sand.	SP-SM, SM	A-1	0-5	70-90	60-80	25-35	5-15	15-20	NP-5
38----------------- Renohill	0-2	Clay loam-------	CL	A-6	0	85-100	80-100	80-95	70-80	25-40	10-20
	2-14	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	14-24	Clay loam-------	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
39*:											
Renohill----------	0-2	Clay loam-------	CL	A-6	0	85-100	80-100	80-95	70-80	25-40	10-20
	2-14	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	14-24	Clay loam-------	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Louviers----------	0-5	Clay------------	CL, CH	A-7, A-6	0	90-100	80-100	80-100	75-95	35-55	15-30
	5-14	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	90-100	80-100	80-100	75-95	35-60	20-35
	14	Weathered bedrock.	---	---	---	---	---	---	---	---	---
40*:											
Torriorthents.											
Rock outcrop.											
41----------------- Truckton	0-5	Sandy loam------	SM-SC	A-2	0	95-100	90-100	50-75	25-35	20-30	5-10
	5-15	Sandy loam------	SC, SM-SC	A-2, A-4, A-6	0	95-100	95-100	60-70	30-40	20-40	5-20
	15-60	Sandy loam, loamy sand, loamy coarse sand.	SC, SM-SC	A-2	0	95-100	95-100	50-65	20-35	20-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
42*:											
Truckton	0-5	Sandy loam	SM-SC	A-2	0	95-100	90-100	50-75	25-35	20-30	5-10
	5-15	Sandy loam	SC, SM-SC	A-2, A-4, A-6	0	95-100	95-100	60-70	30-40	20-40	5-20
	15-60	Sandy loam, loamy sand, loamy coarse sand.	SC, SM-SC	A-2	0	95-100	95-100	50-65	20-35	20-35	5-15
Renohill	0-2	Clay loam	CL	A-6	0	85-100	80-100	80-95	70-80	25-40	10-20
	2-14	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	14-24	Clay loam	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
43 Weld	0-5	Loam	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	5-15	Silty clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	15-45	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	70-95	20-35	5-15
	45-60	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	70-95	20-35	5-15
44 Weld	0-5	Loam	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	5-45	Silty clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	45-60	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	70-95	20-35	5-15
45*:											
Wiley	0-3	Loam	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	3-29	Silty clay loam, silt loam, clay loam.	CL	A-6	0	100	100	90-100	70-95	25-35	10-20
	29-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	80-95	25-35	5-15
Baca	0-4	Loam	CL-ML	A-4	0	100	100	85-95	70-90	20-30	5-10
	4-18	Silty clay loam, clay loam, clay.	CL	A-7, A-6	0	100	100	90-100	75-95	35-50	15-30
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	70-90	25-40	5-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
1, 2----------------- Ascalon	0-4	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low------------	0.17	5	3
	4-22	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate-------	0.24		
	22-45	0.6-6.0	0.11-0.15	7.9-8.4	<2	Low------------	0.24		
	45-60	2.0-6.0	0.06-0.13	7.9-8.4	<2	Low------------	0.17		
3*:									
Baca-------------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low------------	0.32	5	6
	4-18	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate-------	0.24		
	18-60	0.6-2.0	0.16-0.18	7.9-9.0	<2	Moderate-------	0.43		
Wiley------------	0-3	0.6-2.0	0.19-0.21	7.4-7.8	<2	Low------------	0.37	5	4L
	3-29	0.6-2.0	0.19-0.21	7.9-8.4	<2	Moderate-------	0.37		
	29-60	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate-------	0.43		
4*:									
Bluerim----------	0-5	2.0-6.0	0.11-0.13	6.6-7.8	<2	Low------------	0.15	2	3
	5-31	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low------------	0.24		
	31	---	---	---	---	---------------	-----		
Peyton-----------	0-3	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low------------	0.10	5	3
	3-32	0.6-2.0	0.15-0.18	6.6-7.8	<2	Low------------	0.15		
	32-60	2.0-20.0	0.05-0.08	6.6-7.3	<2	Low------------	0.10		
5, 6--------------- Bresser	0-7	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low------------	0.10	5	3
	7-20	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low------------	0.15		
	20-29	0.6-6.0	0.10-0.13	6.6-7.3	<2	Low------------	0.10		
	29-60	2.0-20	0.05-0.08	6.6-7.3	<2	Low------------	0.10		
7*:									
Bresser----------	0-7	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low------------	0.10	5	3
	7-20	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low------------	0.15		
	20-29	0.6-6.0	0.10-0.13	6.6-7.3	<2	Low------------	0.10		
	29-60	2.0-20	0.05-0.08	6.6-7.3	<2	Low------------	0.10		
Cushman----------	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low------------	0.32	2	5
	4-34	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate-------	0.32		
	34	---	---	---	---	---------------	-----		
8*:									
Bresser----------	0-7	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low------------	0.10	5	3
	7-20	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low------------	0.15		
	20-29	0.6-6.0	0.10-0.13	6.6-7.3	<2	Low------------	0.10		
	29-60	2.0-20	0.05-0.08	6.6-7.3	<2	Low------------	0.10		
Stapleton--------	0-37	6.0-20	0.07-0.09	6.1-7.3	<2	Low------------	0.17	5	3
	37-60	6.0-20	0.05-0.07	6.1-7.3	<2	Low------------	0.10		
9*:									
Bresser----------	0-7	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low------------	0.10	5	3
	7-20	0.6-2.0	0.15-0.18	6.6-7.3	<2	Low------------	0.15		
	20-29	0.6-6.0	0.10-0.13	6.6-7.3	<2	Low------------	0.10		
	29-60	2.0-20	0.05-0.08	6.6-7.3	<2	Low------------	0.10		
Truckton---------	0-5	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low------------	0.15	5	3
	5-15	2.0-6.0	0.10-0.13	6.1-7.3	<2	Low------------	0.17		
	15-60	2.0-20	0.07-0.11	6.1-7.3	<2	Low------------	0.17		
10, 11------------- Brussett	0-10	0.6-2.0	0.17-0.20	6.6-7.3	<2	Low------------	0.28	5	6
	10-29	0.2-0.6	0.16-0.18	6.6-7.8	<2	Moderate-------	0.37		
	29-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low------------	0.43		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
12------------- Coni	0-9	0.6-2.0	0.16-0.21	6.1-7.3	<2	Low------------	0.17	1	5
	9-19	0.6-2.0	0.14-0.18	6.1-7.3	<2	Moderate------	0.24		
	19	---	---	---	---	--------------	----		
13------------- Cushman	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low------------	0.32	2	5
	4-34	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate------	0.32		
	34	---	---	---	---	--------------	----		
14*: Cushman----------	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low------------	0.32	2	5
	4-34	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate------	0.32		
	34	---	---	---	---	--------------	----		
Ascalon----------	0-4	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low------------	0.17	5	3
	4-22	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate------	0.24		
	22-45	0.6-6.0	0.11-0.15	7.9-8.4	<2	Low------------	0.24		
	45-60	2.0-6.0	0.06-0.13	7.9-8.4	<2	Low------------	0.17		
15*: Cushman----------	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low------------	0.32	2	5
	4-34	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate------	0.32		
	34	---	---	---	---	--------------	----		
Hargreave--------	0-5	2.0-6.0	0.10-0.14	6.1-7.3	<2	Low------------	0.17	2	3
	5-14	0.6-2.0	0.14-0.16	6.1-7.3	<2	Moderate------	0.24		
	14-24	2.0-6.0	0.10-0.14	6.1-7.3	<2	Low------------	0.24		
	24	---	---	---	---	--------------	----		
16*: Cushman----------	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low------------	0.32	2	5
	4-34	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate------	0.32		
	34	---	---	---	---	--------------	----		
Kutch------------	0-7	0.2-0.6	0.15-0.20	6.1-7.8	<2	High-----------	0.24	2	6
	7-30	0.06-0.2	0.18-0.20	6.1-9.0	<4	High-----------	0.24		
	30	---	---	---	---	--------------	----		
17------------- Elbeth	0-13	0.6-6.0	0.11-0.15	5.1 7.3	<2	Low------------	0.17	5	3
	13-60	0.6-2.0	0.14-0.16	6.1-7.3	<2	Moderate------	0.24		
18*: Elbeth-----------	0-13	0.6-6.0	0.11-0.15	5.1-7.3	<2	Low------------	0.17	5	3
	13-60	0.6-2.0	0.14-0.16	6.1-7.3	<2	Moderate------	0.24		
Kettle-----------	0-22	6.0-20	0.09-0.12	5.1-7.3	<2	Low------------	0.10	5	2
	22-53	6.0-20	0.10-0.13	5.6-7.3	<2	Low------------	0.10		
	53-60	6.0-20	0.06-0.10	5.6-7.3	<2	Low------------	0.10		
19------------- Ellicott	0-7	6.0-20	0.05-0.08	6.1-7.8	<2	Low------------	0.10	5	2
	7-60	6.0-20	0.05-0.08	6.1-7.8	<2	Low------------	0.10		
20------------- Englewood	0-4	0.2-0.6	0.17-0.20	6.6-7.3	<2	Moderate------	0.24	5	4
	4-40	0.06-0.2	0.14-0.16	6.1-7.8	<2	High-----------	0.28		
	40-60	0.06-0.6	0.14-0.17	7.9-9.0	<2	High-----------	0.28		
21*: Fluvaquents									
22*, 23*. Haplustolls									
24------------- Heldt	0-2	0.06-0.6	0.12-0.17	7.9-9.0	<8	High-----------	0.28	5	4
	2-60	0.06-0.2	0.12-0.17	7.9-9.0	<8	High-----------	0.28		
25, 26---------- Holderness	0-4	0.6-2.0	0.17-0.21	6.1-7.3	<2	Low------------	0.24	5	5
	4-38	0.06-0.2	0.15-0.19	6.6-7.8	<2	High-----------	0.28		
	38-60	0.2-0.6	0.15-0.19	7.4 8.4	<2	Moderate------	0.24		

See footnote at end of ta e.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
27----------------- Kettle	0-22	6.0-20	0.09-0.12	5.1-7.3	<2	Low-------------	0.10	5	2
	22-53	6.0-20	0.10-0.13	5.6-7.3	<2	Low-------------	0.10		
	53-60	6.0-20	0.06-0.10	5.6-7.3	<2	Low-------------	0.10		
28*:									
Kettle------------	0-22	6.0-20	0.09-0.12	5.1-7.3	<2	Low-------------	0.10	5	2
	22-53	6.0-20	0.10-0.13	5.6-7.3	<2	Low-------------	0.10		
	53-60	6.0-20	0.06-0.10	5.6-7.3	<2	Low-------------	0.10		
Rock outcrop.									
29, 30------------ Kutch	0-4	0.2-0.6	0.15-0.20	6.1-7.8	<2	High-----------	0.24	2	6
	4-30	0.06-0.2	0.18-0.20	6.1-9.0	<4	High-----------	0.24		
	30	---	---	---	---	---------------	-----		
31*:									
Kutch-------------	0-4	0.2-0.6	0.15-0.20	6.1-7.8	<2	High-----------	0.24	2	6
	4-30	0.06-0.2	0.18-0.20	6.1-9.0	<4	High-----------	0.24		
	30	---	---	---	---	---------------	-----		
Louviers----------	0-5	0.2-0.6	0.14-0.21	6.1-7.8	<2	High-----------	0.32	1	4
	5-14	0.06-0.2	0.13-0.18	6.1-7.8	<2	High-----------	0.37		
	14	---	---	---	---	---------------	-----		
32, 33------------ Nunn	0-8	0.2-2.0	0.15-0.20	6.1-7.8	<2	Moderate-------	0.24	5	6
	8-40	0.06-0.2	0.15-0.18	6.1-8.4	<2	High-----------	0.28		
	40-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate-------	0.24		
34----------------- Peyton	0-3	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low-------------	0.10	5	3
	3-32	0.6-2.0	0.15-0.18	6.6-7.8	<2	Low-------------	0.15		
	32-60	2.0-20	0.05-0.08	6.6-7.3	<2	Low-------------	0.10		
35*:									
Peyton------------	0-3	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low-------------	0.10	5	3
	3-32	0.6-2.0	0.15-0.18	6.6-7.8	<2	Low-------------	0.15		
	32-60	2.0-20	0.05-0.08	6.6-7.8	<2	Low-------------	0.10		
Elbeth------------	0-13	0.6-6.0	0.11-0.15	5.1-7.3	<2	Low-------------	0.17	5	3
	13-60	0.6-2.0	0.14-0.16	6.1-7.3	<2	Moderate-------	0.24		
36*:									
Peyton------------	0-3	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low-------------	0.10	5	3
	3-32	0.6-2.0	0.15-0.18	6.6-7.8	<2	Low-------------	0.15		
	32-60	2.0-20	0.05-0.08	6.6-7.8	<2	Low-------------	0.10		
Pring-------------	0-13	2.0-6.0	0.09-0.13	6.1-7.3	<2	Low-------------	0.15	5	3
	13-27	6.0-20	0.08-0.12	6.6-7.3	<2	Low-------------	0.15		
	27-60	6.0-20	0.05-0.07	6.6-7.3	<2	Low-------------	0.10		
37----------------- Pring	0-13	2.0-6.0	0.09-0.13	6.1-7.3	<2	Low-------------	0.15	5	3
	13-27	6.0-20	0.08-0.12	6.6-7.3	<2	Low-------------	0.15		
	27-60	6.0-20	0.05-0.07	6.6-7.3	<2	Low-------------	0.10		
38----------------- Renohill	0-2	0.2-0.6	0.17-0.21	6.6-7.8	<2	Moderate-------	0.37	3	6
	2-14	0.06-0.2	0.14-0.16	6.6-8.4	<2	High-----------	0.32		
	14-24	0.2-0.6	0.19 0.21	7.9-9.0	<4	Moderate-------	0.37		
	24	---	---	---	---	---------------	-----		
39*:									
Renohill----------	0-2	0.2-0.6	0.17-0.21	6.6-7.8	<2	Moderate-------	0.37	3	6
	2-14	0.06-0.2	0.14-0.16	6.6-8.4	<2	High-----------	0.32		
	14-24	0.2-0.6	0.19-0.21	7.9-9.0	<4	Moderate-------	0.37		
	24	---	---	---	---	---------------	-----		
Louviers----------	0-5	0.2-0.6	0.14-0.21	6.1-7.8	<2	High-----------	0.32	1	4
	5-14	0.06-0.2	0.13-0.18	6.1-7.8	<2	High-----------	0.37		
	14	---	---	---	---	---------------	-----		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
40*:									
Torriorthents.									
Rock outcrop.									
41----------------	0-5	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low------------	0.15	5	3
Truckton	5-15	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low------------	0.17		
	15-60	2.0-20	0.07-0.11	6.1-7.8	<2	Low------------	0.17		
42*:									
Truckton---------	0-5	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low------------	0.15	5	3
	5-15	2.0-6.0	0.10-0.13	6.1-7.8	<2	Low------------	0.17		
	15-60	2.0-20	0.07-0.11	6.1-7.8	<2	Low------------	0.17		
Renohill---------	0-2	0.2-0.6	0.17-0.21	6.6-7.8	<2	Moderate-------	0.37	3	6
	2-14	0.06-0.2	0.14-0.16	6.6-8.4	<2	High-----------	0.32		
	14-24	0.2-0.6	0.19-0.21	7.9-9.0	<4	Moderate-------	0.37		
	24	---	---	---	---	---------------	----		
43----------------	0-5	0.6-2.0	0.16-0.21	6.6-8.4	<2	Low------------	0.32	5	6
Weld	5-15	0.06-0.2	0.19-0.21	6.6-8.4	<2	High-----------	0.28		
	15-45	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate-------	0.28		
	45-60	0.6-2.0	0.12-0.18	7.4-9.0	<2	Low------------	0.28		
44----------------	0-5	0.6-2.0	0.16-0.21	6.6-8.4	<2	Low------------	0.32	5	6
Weld	5-45	0.06-0.2	0.19-0.21	6.6-8.4	<2	High-----------	0.28		
	45-60	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate-------	0.28		
45*:									
Wiley------------	0-3	0.6-2.0	0.19-0.21	7.4-7.8	<2	Low------------	0.37	5	4L
	3-29	0.6-2.0	0.19-0.21	7.9-8.4	<2	Moderate-------	0.37		
	29-60	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate-------	0.43		
Baca-------------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low------------	0.32	5	6
	4-18	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate-------	0.24		
	18-60	0.6-2.0	0.16-0.18	7.9-9.0	<2	Moderate-------	0.43		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definition of "flooding" in the Glossary explains terms such as "rare" and "brief". The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
1, 2 Ascalon	B	None	---	---	>60	---	Moderate	Moderate	Low.
3*:									
Baca	C	None	---	---	>60	---	Low	High	Low.
Wiley	B	None	---	---	>60	---	Low	High	Low.
4*:									
Bluerim	B	None	---	---	20-40	Rippable	Low	High	Low.
Peyton	B	None	---	---	>60	---	Moderate	Moderate	Low.
5, 6 Bresser	B	None	---	---	>60	---	Moderate	Moderate	Low.
7*:									
Bresser	B	None	---	---	>60	---	Moderate	Moderate	Low.
Cushman	C	None	---	---	20-40	Rippable	Low	High	Low.
8*:									
Bresser	B	None	---	---	>60	---	Moderate	Moderate	Low.
Stapleton	B	None	---	---	>60	---	Moderate	Moderate	Low.
9*:									
Bresser	B	None	---	---	>60	---	Moderate	Moderate	Low.
Truckton	B	None	---	---	>60	---	Moderate	Moderate	Moderate.
10, 11 Brussett	B	None	---	---	>60	---	Moderate	High	Low.
12 Coni	D	None	---	---	10-20	Hard	Moderate	Low	Low.
13 Cushman	C	None	---	---	20-40	Rippable	Low	High	Low.
14*:									
Cushman	C	None	---	---	20-40	Rippable	Low	High	Low.
Ascalon	B	None	---	---	>60	---	Moderate	Moderate	Low.
15*:									
Cushman	C	None	---	---	20-40	Rippable	Low	High	Low.
Hargreave	C	None	---	---	20-40	Rippable	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
16*:									
Cushman	C	None	---	---	20-40	Rippable	Low	High	Low.
Kutch	C	None	---	---	20-40	Rippable	Moderate	High	Moderate.
17 Elbeth	B	None	---	---	>60	---	Moderate	High	Moderate.
18*:									
Elbeth	B	None	---	---	>60	---	Moderate	High	Moderate.
Kettle	B	None	---	---	>60	---	Low	Moderate	Low.
19 Ellicott	A	Frequent	Brief	Mar-Jun	>60	---	Low	Moderate	Low.
20 Englewood	C	None	---	---	>60	---	Moderate	High	Low.
21*. Fluvaquents									
22*, 23*. Haplustolls									
24 Heldt	C	None	---	---	>60	---	Low	High	High.
25, 26 Holderness	C	None	---	---	>60	---	Moderate	High	Low.
27 Kettle	B	None	---	---	>60	---	Low	Moderate	Low.
28*:									
Kettle	B	None	---	---	>60	---	Low	Moderate	Low.
Rock outcrop.									
29, 30 Kutch	C	None	---	---	20-40	Rippable	Moderate	High	Moderate.
31*:									
Kutch	C	None	---	---	20-40	Rippable	Moderate	High	Moderate.
Louviers	D	None	---	---	8-20	Rippable	Low	High	Low.
32, 33 Nunn	C	None	---	---	>60	---	Moderate	High	Low.
34 Peyton	B	None	---	---	>60	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
35*:									
Peyton	B	None	---	---	>60	---	Moderate	Moderate	Low.
Elbeth	B	None	---	---	>60	---	Moderate	High	Moderate.
36*:									
Peyton	B	None	---	---	>60	---	Moderate	Moderate	Low.
Pring	B	None	---	---	>60	---	Moderate	Moderate	Low.
37 Pring	B	None	---	---	>60	---	Moderate	Moderate	Low.
38 Renohill	C	None	---	---	20-40	Rippable	Low	High	Low.
39*:									
Renohill	C	None	---	---	20-40	Rippable	Low	High	Low.
Louviers	D	None	---	---	8-20	Rippable	Low	High	Low.
40*:									
Torriorthents.									
Rock outcrop.									
41 Truckton	B	None	---	---	>60	---	Moderate	Moderate	Moderate.
42*:									
Truckton	B	None	---	---	>60	---	Moderate	Moderate	Moderate.
Renohill	C	None	---	---	20-40	Rippable	Low	High	Low.
43, 44 Weld	C	None	---	---	>60	---	Moderate	High	Low.
45*:									
Wiley	B	None	---	---	>60	---	Low	High	Low.
Baca	C	None	---	---	>60	---	Low	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Baca	Fine, montmorillonitic, mesic Ustollic Haplargids
Bluerim	Fine-loamy, mixed Borollic Haplargids
Bresser	Fine-loamy, mixed, mesic Aridic Argiustolls
Brussett	Fine-silty, mixed Aridic Argiborolls
Coni	Loamy, mixed Lithic Argiborolls
Cushman	Fine-loamy, mixed, mesic Ustollic Haplargids
Elbeth	Fine-loamy, mixed Typic Eutroboralfs
Ellicott	Sandy, mixed, mesic Ustic Torrifluvents
Englewood	Fine, montmorillonitic, mesic Torrertic Argiustolls
Hargreave	Fine-loamy, mixed, mesic Aridic Argiustolls
Heldt	Fine, montmorillonitic, mesic Ustertic Camborthids
Holderness	Fine, montmorillonitic Aridic Argiborolls
Kettle	Coarse-loamy, mixed Psammentic Eutroboralfs
Kutch	Fine, montmorillonitic, mesic Torrertic Argiustolls
Louviers	Clayey, montmorillonitic, nonacid, mesic, shallow Ustic Torriorthents
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Peyton	Fine-loamy, mixed Aridic Argiborolls
Pring	Coarse-loamy, mixed Aridic Haploborolls
Renohill	Fine, montmorillonitic, mesic Ustollic Haplargids
Stapleton	Coarse-loamy, mixed, mesic Aridic Haplustolls
Truckton	Coarse-loamy, mixed, mesic Aridic Argiustolls
Weld	Fine, montmorillonitic, mesic Aridic Paleustolls
Wiley	Fine-silty, mixed, mesic Ustollic Haplargids

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