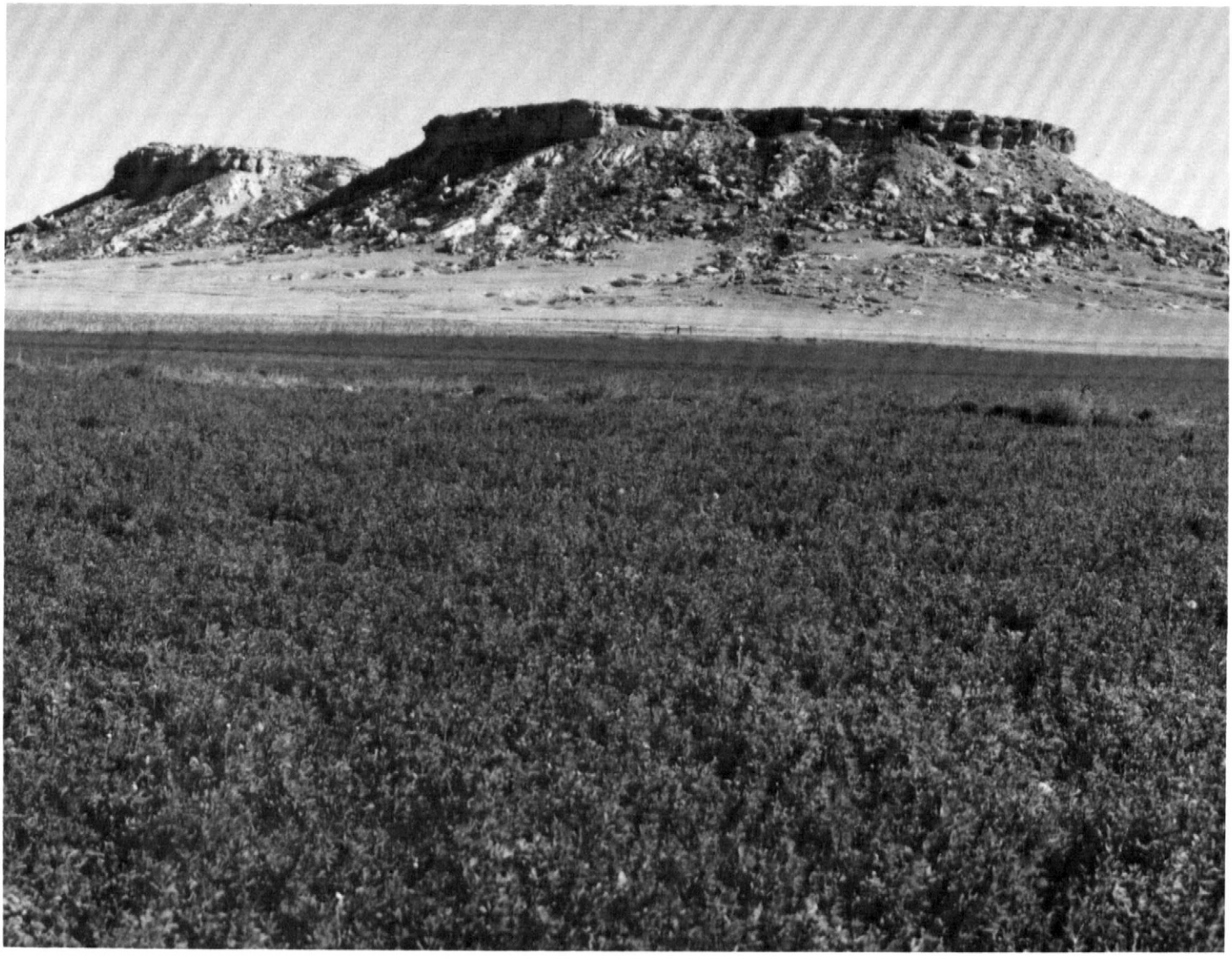
United States Department of Agriculture

Soil Conservation Service

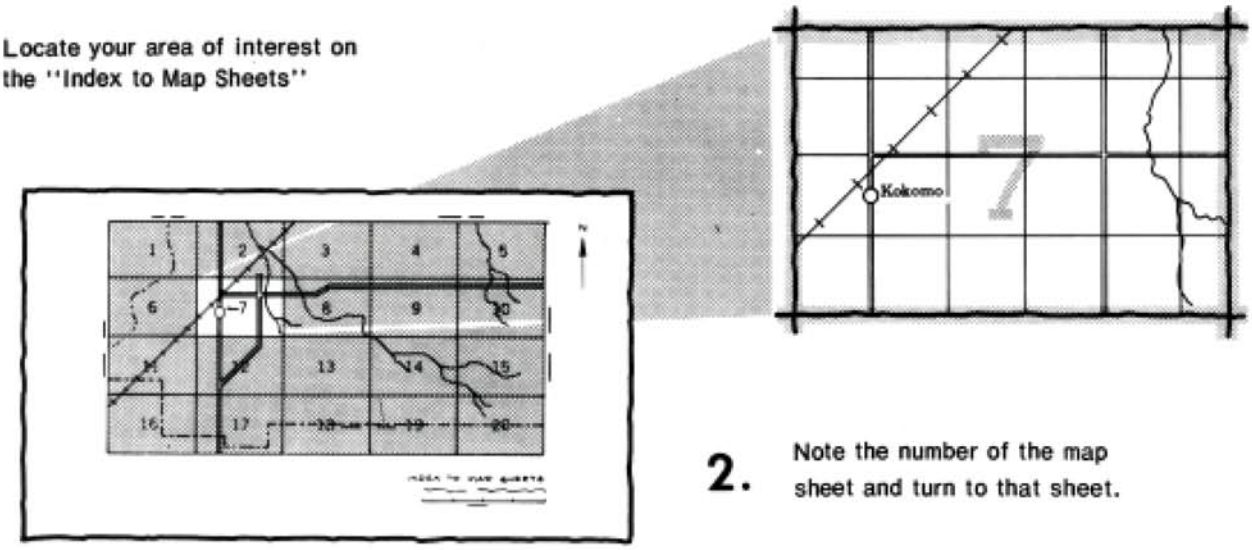
In cooperation with Wyoming Agricultural Experiment Station

Soil Survey of Laramie County, Wyoming, Eastern Part



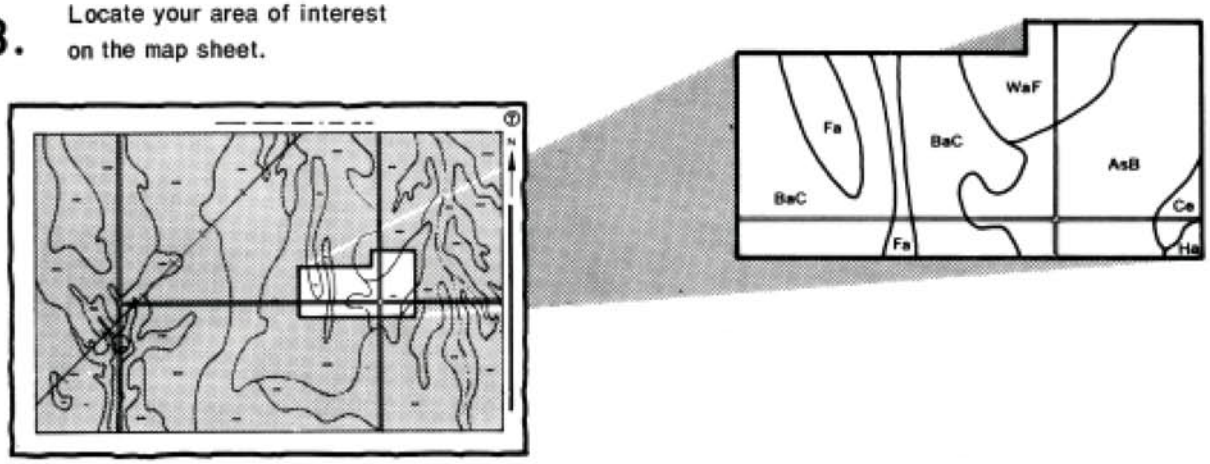
HOW TO USE

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

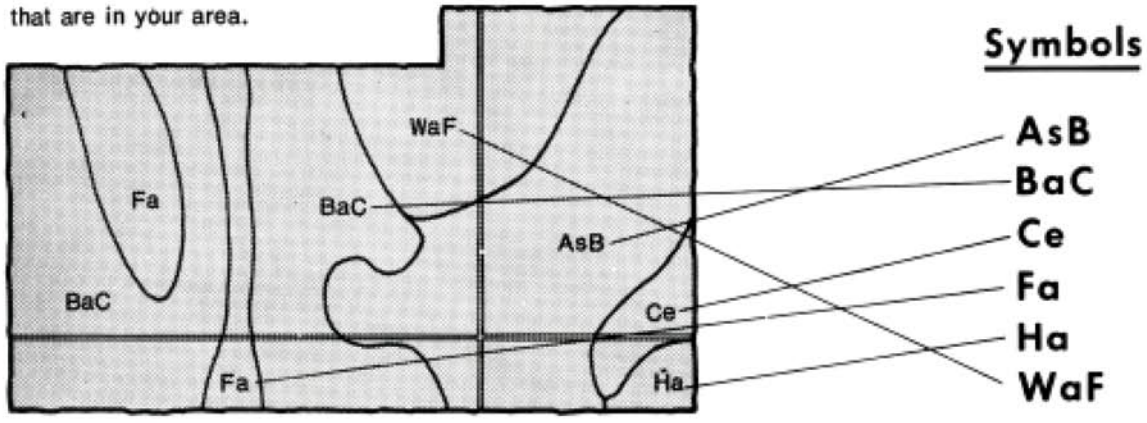


2. Note the number of the map sheet and turn to that sheet.

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

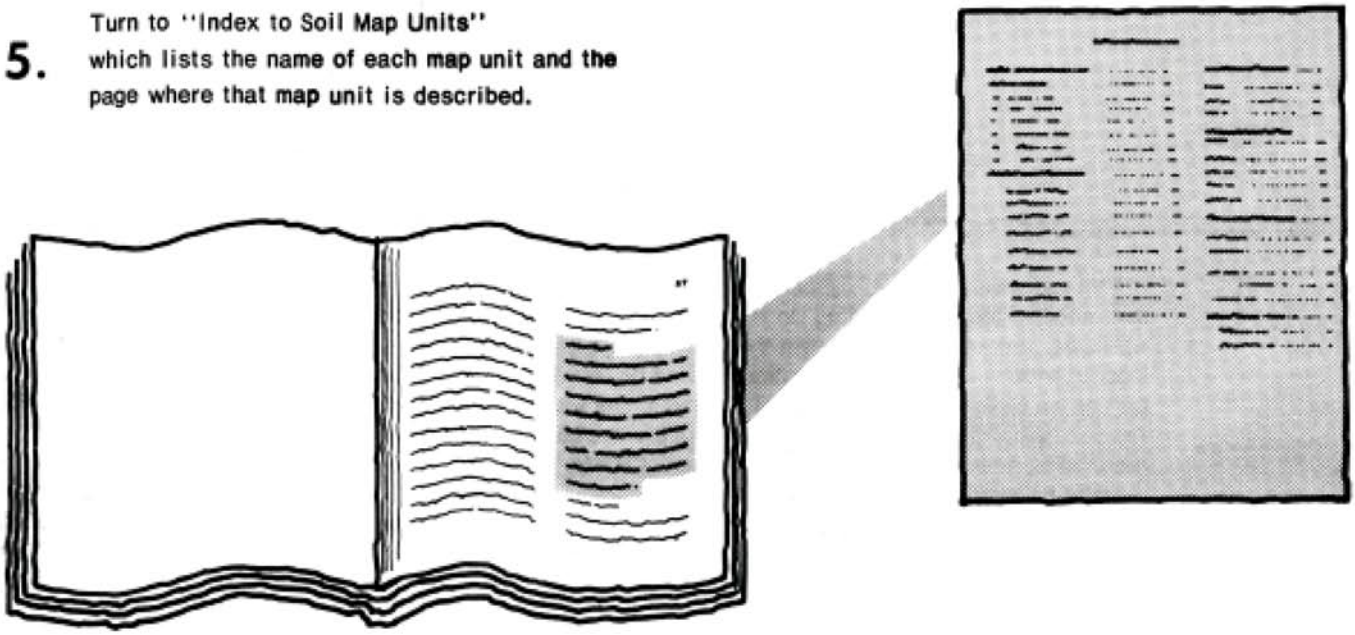


4. List the map unit symbols that are in your area.

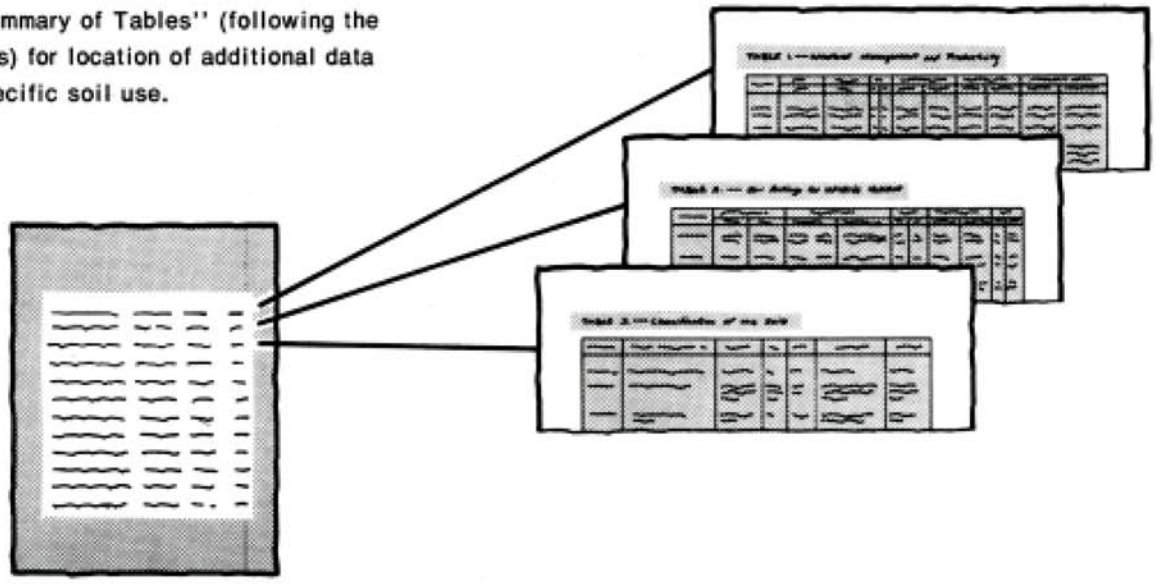


THIS SOIL SURVEY

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; to specialists in wildlife management, waste disposal, or pollution control.

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

Major fieldwork for this soil survey was performed in the period 1970-79. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service, the Wyoming Agricultural Experiment Station, and the Wyoming Department of Revenue and Taxation. It is part of the technical assistance furnished to the Southeastern Laramie County Conservation District.

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

Cover: Typical area south of Pine Bluffs. In the foreground is a field of alfalfa on Alice fine sandy loam, 0 to 3 percent slopes. In the far background is an area of Treon, thin solum-Rock outcrop-Treon complex, 15 to 30 percent slopes.

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Issued December 1983

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foreword

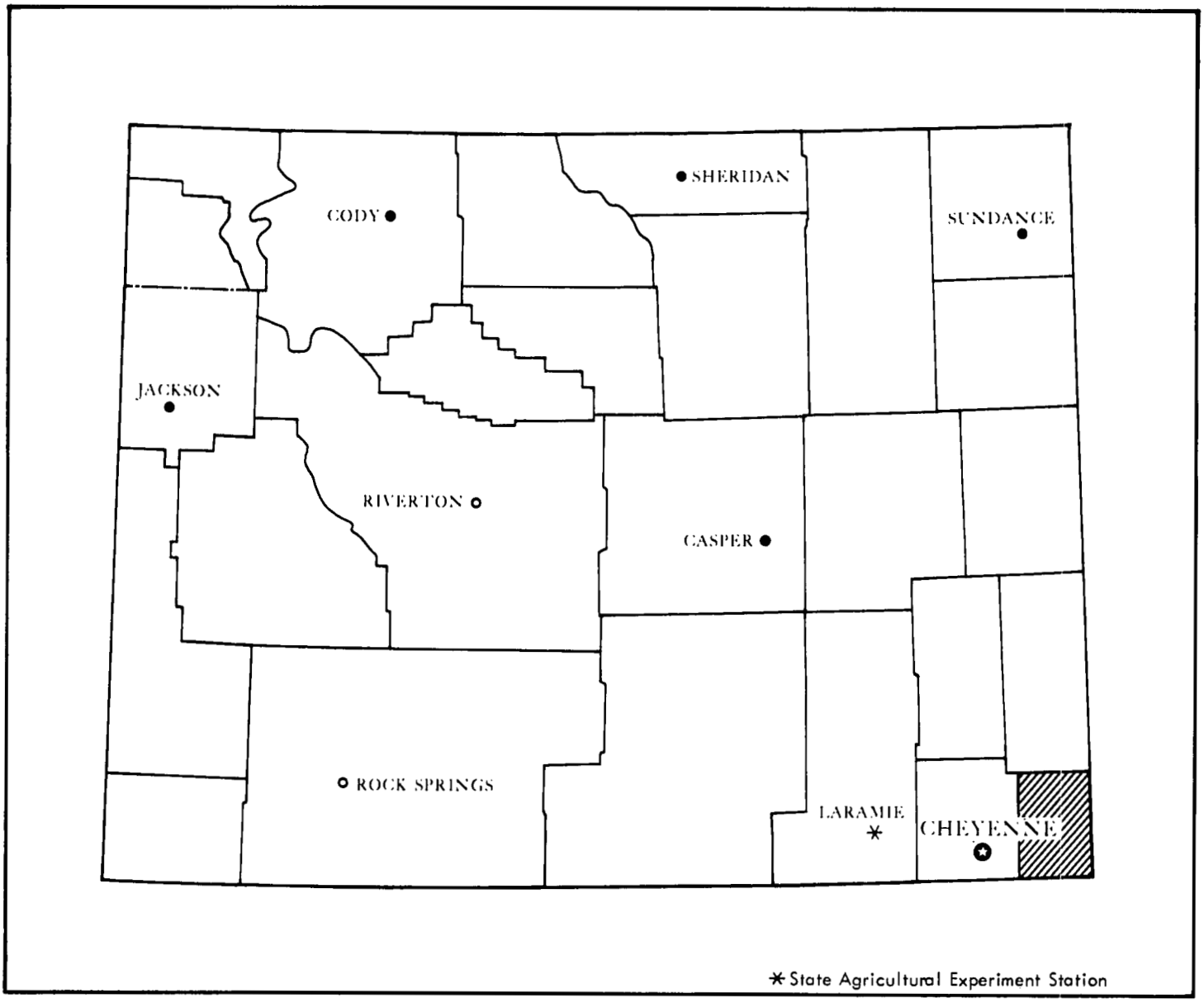
This soil survey contains information that can be used in land-planning programs in Laramie County, Wyoming, Eastern Part. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations,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

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

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

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

Frank S. Dickson, Jr.
State Conservationist
Soil Conservation Service



Location of Laramie County, Wyoming, Eastern Part.

soil survey of
Laramie County, Wyoming, Eastern Part

By Abe Stevenson, Michael D. Lloyd, and Lionell Joseph,
Soil Conservation Service

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

LARAMIE COUNTY, WYOMING, EASTERN PART, is in the southeastern part of Wyoming. It has a total area of 699,887 acres, or about 1,093 square miles. Of this, about 651,391 acres is privately owned, 41,860 acres is administered by the state, 560 acres is administered by the Bureau of Land Management, and 6,076 acres is used for public facilities. The main towns are Pine Bluffs, population 937; Burns, 200; Albin, 118; Carpenter, 100; and Hillsdale, 80.

Elevation ranges from about 5,850 feet at Durham, at the western edge of the survey area, to about 5,000 feet at Pine Bluffs, at the eastern edge. Precipitation is about 15 inches, and the frost-free season ranges from 120 to 140 days.

The public transportation system in the survey area is excellent. Two railroads, five highways, two buslines, and two airlines serve the area. The center of the transportation system is Cheyenne.

The main economic enterprises in the area are ranching, growing nonirrigated and irrigated crops, and dairy farming.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

general nature of the survey area

This section briefly discusses the history and development, natural resources, and climate of the survey area.

history and development

The first white settlers in the survey area were the owners and employees of a large cattle operation (*4*). Originally, the cattle were trailed from Texas and other southern points to Wyoming to be fattened on the native grasses. After the grazing season was over, the cattle were shipped to market. Later, cattlemen decided that Wyoming would be a profitable place to operate year-round ranches because the cattle would thrive on the dried grasses available on the range in winter. Thus, in the 1870's the first permanent settlers came to the area to operate year-round ranches. The cattle were shipped by rail from Pine Bluffs.

During the early days, settlers did not realize that some day the area would develop into a good general farming area. The gradual change from ranching to general farming began some years after the first settlers arrived. It was discovered that the soils in the area produced good yields of oats—sometimes 100 bushels or more per acre. As time passed, other crops were also grown successfully.

As more settlers arrived in the area, schools were established. At present there are schools in Pine Bluffs, Carpenter, and Burns.

The Rural Electric Company began providing service in the area in the 1940's. It serves about 85 percent of the rural population.

natural resources

Soil, surface and underground water, oil, sand, gravel, and the native vegetation are the major natural resources of the survey area. The soil, if properly managed, can be expected to yield benefits without depletion.

The quantity of water available for irrigation and other uses depends mainly on the amount of snow that accumulates in the Laramie Mountains. As it melts, this snow recharges the ground water system. Rainfall also contributes to the recharge of the ground water; however, it makes up only about 5 percent of the total annual precipitation in the mountains.

The total amount of ground water pumped from wells in the area in 1964 was estimated to be 28,000 acre-feet. Of this, about 6,000 acre-feet was used for municipal and industrial purposes, about 17,000 acre-feet was used for irrigation in the Pine Bluffs and Carpenter areas, and about 5,000 acre-feet was used for other purposes. The balance of the recharge, about 80,400 acre-feet, is discharged by streamflow and lost through evapotranspiration.

Moderate to high yields of water can be obtained in the northeastern part of the area, where the thickness of the saturated part of the Arikaree and Ogallala Formations is 200 feet or more (*3*).

A few oil wells have been developed during the last 10 years, but they are not large producers.

An abundance of sand and gravel is available for building roads and other structures. These materials are on the gravelly alluvial terraces in the area.

The native vegetation has been plowed under in some areas and the soils used as nonirrigated and irrigated cropland.

climate

The climate in the survey area is semiarid. The high elevation and dry air contribute to wide variations in temperature between summer and winter and in the daily maximum and minimum temperatures. Freezing temperatures late in spring and early in fall are common; however, the mean temperature in winter is significantly higher than would be expected at such high elevations.

The Laramie Mountains, which form part of the Continental Divide, have an appreciable effect on the climate. These mountains extend in a north-south direction and are about 9,000 feet high. From the foot of the mountains, the terrain slopes gradually to the east.

Downslope winds, which are northwesterly, are warmed and dried by the compression of the air. Because of this downslope warming, the temperatures in winter are considerably modified. Most of the cold air, which is mainly from Canada, does not remain in the area for more than 1 to 3 days because the prevailing westerly winds and general decrease in elevation from west to east tend to move the cold air eastward. Moisture from the Pacific Ocean is largely blocked off by the Laramie Mountains.

Average precipitation is least during December through February. Precipitation increases rapidly to a peak in May and then decreases to a low in winter. Precipitation in winter is mainly in the form of snow. In summer it falls mainly during showers and thunderstorms. Precipitation in spring and fall is mainly a combination of snow and rain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Pine Bluffs in the period 1941 to 1970. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 30 degrees F and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred at Pine Bluffs on December 9, 1919, is -38 degrees. In summer, the average temperature is 68 degrees and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Pine Bluffs on July 15, 1934, is 109 degrees.

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

The total annual precipitation is 15 inches. Of this, 11 inches, or 75 percent, usually falls in April through September, which includes the growing season for most crops.

Average seasonal snowfall is 46 inches. The greatest snow depth at any one time during the period of record was 39 inches. On an average of 3 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 55 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the northwest. Average windspeed is 13 miles per hour.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the

kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

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

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

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

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

general soil map units

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

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

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

The 11 map units in this survey have been grouped into 4 general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

soil descriptions

soils on flood plains

This group consists of one map unit. It makes up about 1 percent of this survey area. The soils in this group are nearly level. The native vegetation is mainly grasses, forbs, shrubs, and cottonwood.

The soils in this group are deep and are somewhat poorly drained and poorly drained. They formed in alluvium derived from mixed sources.

This group is used mainly as rangeland. It is also used as hayland.

1. Bayard Variant-Merden Variant-Merden

Deep, somewhat poorly drained and poorly drained, nearly level soils; on flood plains

This map unit is in the northern and southern parts of the survey area. Slope is 0 to 3 percent. The vegetation on this unit is mainly grasses, forbs, shrubs, and cottonwood.

This unit makes up about 1 percent of the survey area. It is about 30 percent Bayard Variant soils, 30 percent Merden Variant soils, and 10 percent Merden soils. The remaining 30 percent is components of minor extent.

Bayard Variant soils are on flood plains. These soils are deep and somewhat poorly drained. They formed in alluvium derived from mixed sources. The soils are moderately coarse textured and have a water table at a depth of 24 to 60 inches.

Merden Variant soils are on flood plains. These soils are deep and poorly drained. They formed in alluvium derived dominantly from siltstone. The surface layer is fine textured. The underlying material is medium textured. These soils are strongly affected by salt and alkali.

Merden soils are on flood plains. These soils are deep and poorly drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout. They are strongly affected by salt and alkali.

Of minor extent in this unit are well drained Bayard and Vetal soils.

Most areas of this unit are used as rangeland. A few areas are used as hayland.

This unit is suited to hay and pasture. It is limited by the content of salt and alkali in the Merden Variant and Merden soils, the hazard of flooding, and the fluctuating water table in the Bayard Variant soils.

soils dominantly on fans and terraces

This group consists of three map units. It makes up about 60 percent of this survey area. The soils in this group are nearly level to rolling. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs.

The soils in this group are deep and are well drained and excessively drained. They formed in alluvium derived from mixed sources.

This group is used mainly as nonirrigated and irrigated cropland. It is also used as rangeland.

2. Altvan-Ascalon

Deep, well drained, nearly level to rolling soils; on terraces and plains

This map unit is in the southern part of the survey area. It is characterized by smooth to slightly dissected slopes of 0 to 10 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs.

This unit makes up about 30 percent of the survey area. It is about 45 percent Altvan soils and 40 percent

Ascalon soils. The remaining 15 percent is components of minor extent.

Altvan soils are in nearly level to rolling areas on alluvial terraces. These soils formed in alluvium derived from mixed sources. They are medium textured and are underlain by gravelly, coarse textured material at a depth of 20 to 40 inches.

Ascalon soils are in nearly level to undulating areas on plains. These soils formed in alluvium derived from mixed sources. They are medium textured throughout.

Of minor extent in this unit are Dix, Albinas, and Wages soils.

This unit is used mainly for irrigated and nonirrigated crops. It is also used as rangeland.

If this unit is used as cropland, the main limitations are a hazard of wind erosion and the restricted available water capacity of the Altvan soils.

3. Albinas-Nucla-Mitchell

Deep, well drained, nearly level to rolling soils; on fans and terraces

This map unit is in the northern and southeastern parts of the survey area. Slope is 0 to 10 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs.

This unit makes up about 15 percent of the survey area. It is about 65 percent Albinas soils, 12 percent Nucla soils, and 12 percent Mitchell soils. The remaining 11 percent is components of minor extent.

Albinas soils are in nearly level areas on alluvial terraces. These soils formed in alluvium derived from mixed sources. They are medium textured throughout.

Nucla soils are in nearly level to undulating areas on alluvial fans and terraces. These soils formed in loamy calcareous alluvium derived from mixed sources. They are medium textured throughout.

Mitchell soils are in nearly level to rolling areas on fans and terraces. These soils formed in silty calcareous alluvium. They are medium textured throughout.

Of minor extent in this unit are Ascalon, Altvan, and Wages soils.

This unit is used mainly as nonirrigated and irrigated cropland. It is also used as rangeland.

This unit is well suited to climatically adapted crops. It is limited by low annual precipitation.

4. Vetal-Valent-Otero

Deep, well drained and excessively drained, nearly level to rolling soils; on fans, terraces, and plains

This map unit is in the northeastern and southeastern parts of the survey area. Slope is 0 to 10 percent. The vegetation on this unit is mainly grasses, forbs, and shrubs.

This unit makes up about 15 percent of the survey area. It is about 50 percent Vetal soils, 20 percent Valent soils, and 10 percent Otero soils. The remaining 20 percent is components of minor extent.

Vetal soils are in nearly level to undulating areas on alluvial fans and terraces. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are moderately coarse textured throughout.

Valent soils are in nearly level to rolling areas on plains. These soils are deep and excessively drained. They formed in noncalcareous eolian sand. The soils are coarse textured throughout.

Otero soils are in nearly level to rolling areas on fans and terraces. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout.

Of minor extent in this unit are Bayard, Tassel, Alice, and Aberone soils.

Most areas of this unit are used as irrigated and nonirrigated cropland. A few areas are used as rangeland.

If this unit is used as cropland, the main limitations are a hazard of wind erosion and droughtiness. The unit is well suited to use as rangeland. The production of forage is limited by the low available water capacity of the Valent soils.

soils on dissected fans, terraces, uplands, and plains

This group consists of four map units. It makes up about 29 percent of this survey area. The soils in this group are nearly level to hilly. The vegetation in areas not cultivated is mainly grasses, shrubs, and forbs.

The soils in this group are deep and shallow and are well drained and excessively drained. They formed mainly in alluvium derived from mixed sources.

Most areas of this group are used as rangeland. Some areas are used for irrigated and nonirrigated crops, mainly wheat and potatoes. Among the other crops grown are corn and beans.

5. Ascalon-Altvan-Treon

Deep and shallow, well drained, nearly level to hilly soils; on plains, terraces, and uplands

This map unit is in the northern half of the survey area. It is characterized by shallow drainageways. Slope is 0 to 30 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs.

This unit makes up about 7 percent of the survey area. It is about 40 percent Ascalon soils, 35 percent Altvan soils, and 10 percent Treon soils. The remaining 15 percent is components of minor extent.

Ascalon soils are in nearly level areas on alluvial plains. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout.

Altvan soils are in nearly level areas on alluvial terraces. These soils are deep and well drained. They

formed in alluvium derived from mixed sources. The soils are medium textured and are underlain by gravelly, coarse textured material at a depth of 20 to 40 inches.

Treon soils are in undulating to hilly areas on uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured and are underlain by sandstone at a depth of 6 to 20 inches.

Of minor extent in this unit are Tassel, Bayard, and Aberone soils.

Most areas of this unit are used for irrigated and nonirrigated crops, mainly wheat and potatoes. Among the other crops grown are corn and beans. Some areas are used as rangeland.

If this unit is used as cropland, the main limitations are depth to rock and the very low available water capacity of the Treon soils, depth to gravelly, coarse textured material and the low available water capacity of the Altvan soils, and a hazard of wind erosion.

6. Manter-Treon-Valent

Deep and shallow, well drained and excessively drained, nearly level to rolling soils; on terraces, uplands, and plains

This map unit is in the northwestern part of the survey area. It is characterized by rolling terraces and sandstone ridges. Slope is 0 to 10 percent. The vegetation is mainly grasses, forbs, and shrubs.

This unit makes up about 7 percent of the survey area. It is about 40 percent Manter soils, 20 percent Treon soils, and 20 percent Valent soils. The remaining 20 percent is components of minor extent.

Manter soils are in nearly level to rolling areas on terraces. These soils are deep and well drained. They formed in outwash and eolian sediment. The surface layer is moderately coarse textured. The subsoil is moderately coarse textured and is calcareous in the lower part.

Treon soils are in undulating to rolling areas on uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured and are underlain by sandstone at a depth of 6 to 20 inches.

Valent soils are in nearly level to rolling areas on plains. These soils are deep and excessively drained. They formed in eolian sand. The soils are coarse textured throughout.

Of minor extent in this unit are Ascalon, Bayard, and Vetal soils.

This unit is used as rangeland. The production of forage is limited by the restricted available water capacity of the Treon and Valent soils.

7. Vetal-Bayard-Treon

Deep and shallow, well drained, nearly level to rolling soils; on fans, terraces, and uplands

This map unit is in the northwestern part of the survey area. It is dissected by shallow drainageways. Slope is 0 to 10 percent. The vegetation is mainly grasses, forbs, and shrubs.

This unit makes up about 5 percent of the survey area. It is about 40 percent Vetal soils, 40 percent Bayard soils, and 10 percent Valent soils. The remaining 10 percent is components of minor extent.

Vetal soils are in nearly level to undulating areas on alluvial fans. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are moderately coarse textured throughout.

Bayard soils are in nearly level to rolling areas on alluvial fans and terraces. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are moderately coarse textured throughout.

Treon soils are in undulating to rolling areas on uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured throughout and are underlain by sandstone at a depth of 6 to 20 inches.

Of minor extent in this unit are Tassel, Alice, and Aberone soils.

This unit is used as rangeland.

This unit is well suited to irrigated crops if water is made available. If the unit is used for nonirrigated crops, the main limitations are a hazard of wind erosion on all the soils and the droughtiness of the Valent soils.

8. Altvan-Dix-Treon

Deep and shallow, well drained and excessively drained, undulating to hilly soils; on terraces, hills, and uplands

This map unit is in the central part of the survey area. It is dissected by deep drainageways. Slope is 5 to 20 percent. The vegetation is mainly grasses, forbs, and shrubs.

This unit makes up about 10 percent of the survey area. It is about 60 percent Altvan soils, 20 percent Dix soils, and 10 percent Treon soils. The remaining 10 percent is components of minor extent.

Altvan soils are in undulating areas on alluvial terraces. These soils are deep and well drained. They formed in alluvium derived from mixed sources. They are medium textured and are underlain by gravelly, coarse textured material at a depth of 20 to 40 inches.

Dix soils are in undulating to hilly areas on terraces. These soils are deep and excessively drained. They formed in gravelly sandy alluvium derived from mixed sources. The surface layer is very gravelly and moderately coarse textured. The underlying material is very gravelly and coarse textured.

Treon soils are in undulating to hilly areas on hills and uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured and are underlain by bedrock at a depth of 6 to 20 inches.

Of minor extent in this unit are Tassel, Bayard, and Aberone soils.

This unit is used as rangeland. The production of forage is limited by the low available water capacity of the Dix and Treon soils.

soils on uplands, fans, and terraces

This group consists of three map units. It makes up about 10 percent of the survey area. The soils in this group are nearly level to steep. The native vegetation is mainly grasses, forbs, and shrubs.

The soils in this group are deep and shallow and are well drained and excessively drained. They formed in alluvium and in material derived dominantly from calcareous sandstone.

This group is used mainly as rangeland and for wildlife habitat. Some areas are used for irrigated and nonirrigated crops.

9. Treon-Aberone

Shallow and deep, well drained, moderately steep to steep soils; on terraces, hills, and uplands

This map unit is in the southeastern part of the survey area. It is dissected by deep drainageways and is characterized by areas of exposed rock. Slope is 10 to 30 percent. The vegetation is mainly grasses, forbs, and shrubs.

This unit makes up about 3 percent of the survey area. It is about 50 percent Treon soils and 40 percent Aberone soils. The remaining 10 percent is components of minor extent.

Treon soils are in moderately steep to steep areas on hills and uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured throughout and are underlain by bedrock at a depth of 6 to 20 inches.

Aberone soils are in moderately steep areas on high terraces. These soils are deep and well drained. They formed in calcareous alluvium. The soils are moderately coarse textured throughout and are very gravelly in the lower part.

Of minor extent in this unit are Tassel and Bayard soils.

This unit is used as rangeland and for wildlife habitat. The production of forage is limited by the restricted available water capacity.

10. Treon-Nucla-Ascalon

Deep and shallow, well drained, nearly level to hilly soils; on fans, uplands, and plains

This map unit is in the southeastern part of the survey area. Slope is 0 to 30 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs.

This unit makes up about 2 percent of the survey area. It is about 40 percent Treon soils, 35 percent Nucla soils, and 20 percent Ascalon soils. The remaining 5 percent is components of minor extent.

Treon soils are in sloping to hilly areas on uplands. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured throughout and are underlain by sandstone at a depth of 6 to 20 inches.

Nucla soils are in nearly level to sloping areas on alluvial fans. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout and are highly calcareous in the lower part.

Ascalon soils are in nearly level to sloping areas on plains. These soils are deep and well drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout.

Of minor extent in this unit are Altvan, Albinas, and Wages soils.

Most areas of this unit are used for irrigated and nonirrigated crops. A few areas are used as rangeland.

The main limitations of this unit for use as cropland are a hazard of wind erosion on all the soils and depth to rock in the Treon soils.

11. Tassel-Otero-Valent

Shallow and deep, well drained and excessively drained, undulating to steep soils; on fans, terraces, uplands, and plains

This map unit is in the northern part of the survey area. It is dissected by deep drainageways. Slope is 5 to 30 percent. The vegetation on this unit is mainly grasses, forbs, and shrubs.

This unit makes up about 5 percent of the survey area. It is about 50 percent Tassel soils, 25 percent Otero soils, and 20 percent Valent soils. The remaining 5 percent is components of minor extent.

Tassel soils are in sloping to steep areas on uplands, mainly on ridge crests. These soils are shallow and well drained. They formed in material derived dominantly from calcareous sandstone. The soils are moderately coarse textured and are underlain by bedrock at a depth of 6 to 20 inches.

Otero soils are in sloping to steep areas on fans and terraces. These soils are deep and well drained. They formed in calcareous alluvium derived from mixed sources. The soils are moderately coarse textured throughout.

Valent soils are in undulating to rolling areas on plains. These soils are deep and excessively drained. They formed in eolian material derived from mixed sources. The soils are coarse textured throughout.

Of minor extent in this unit are Bayard, Jayem, and Vetal soils.

This unit is used as rangeland and for wildlife habitat. The production of forage is limited by the restricted available water capacity of the Tassel and Valent soils.

detailed soil map units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Treon fine sandy loam, 6 to 10 percent slopes, is one of several phases in the Treon series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Dix-Altvan complex, 10 to 30 percent slopes, is an example.

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

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

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Albinas loam, 0 to 1 percent slopes. This deep, well drained soil is on alluvial terraces. It formed in alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loam 4 inches thick. The upper 20 inches of the subsoil is dark brown sandy clay loam, and the lower 8 inches is dark yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown loam.

Included in this unit are small areas of Altvan loam and Ascalon loam on the edges of alluvial terraces. Included areas make up about 15 percent of the total acreage.

Permeability of this Albinas soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. To avoid

overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is well suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIc, irrigated, and IIIc, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

2—Albinas loam, 1 to 3 percent slopes. This deep, well drained soil is on alluvial terraces. It formed in alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loam 4 inches thick. The upper 20 inches of the subsoil is dark brown sandy clay loam, and the lower 8 inches is dark yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown loam.

Included in this unit are small areas of Altvan loam and Ascalon loam on the edges of alluvial terraces. Included areas make up about 15 percent of the total acreage.

Permeability of this Albinas soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition.

Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

3—Alice fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial terraces. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 4 inches thick. The subsoil is brown fine sandy loam 21 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown fine sandy loam.

Included in this unit are small areas of Bayard fine sandy loam on low ridges and knolls and Manter and Jayem soils in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Alice soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because permeability is moderately rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low annual precipitation. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

4—Alice fine sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on alluvial terraces. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 4 inches thick. The subsoil is brown fine sandy loam 21 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown fine sandy loam.

Included in this unit are small areas of Bayard fine sandy loam on low ridges and knolls and Manter and Jayem soils in nearly level areas of swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Alice soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for

seedbed preparation and weed control, using diversions and grassed waterways, and maintaining a rough and cloddy surface. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

If this unit is used for irrigated crops, the main limitation is slope. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low annual precipitation. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

5—Altvan loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial terraces. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark grayish brown loam 9 inches thick. The upper 16 inches of the subsoil is dark brown sandy clay loam, and the lower 3 inches is brown sandy clay loam. The substratum to a depth of 60 inches or more is brown very gravelly sand. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Albinas loam in swales, Ascalon loam in swales and on low terraces, and Wages loam on the edge of alluvial terraces. Included areas make up about 10 percent of the total acreage.

Permeability of this Altvan soil is moderate to a depth of 28 inches and very rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used for nonirrigated and irrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation, the low available water capacity, and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Other practices that can be used to control erosion include seeding early in fall, stubble mulching, and constructing terraces, diversions, and grassed waterways. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. All tillage should be on the contour or across the slope.

This unit is well suited to irrigated crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. If this unit is used for hay and pasture, it is limited by the low available water capacity.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired

balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation and low available water capacity. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the low available water capacity and low annual precipitation. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

6—Altvan loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on alluvial terraces. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark grayish brown loam 9 inches thick. The upper 16 inches of the subsoil is dark brown sandy clay loam, and the lower 3 inches is brown sandy clay loam. The substratum to a depth of 60 inches or more is brown very gravelly sand. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Albinas loam and Ascalon loam in swales and Wages loam on the edge of alluvial terraces. Included areas make up about 10 percent of the total acreage.

Permeability of this Altvan soil is moderate to a depth of 28 inches and very rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation, the low available water capacity, and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, constructing diversions and grassed waterways, and keeping the surface rough and cloddy.

If this unit is used for irrigated crops, the main limitations are the low available water capacity and slope. Sprinkler irrigation is the most suitable method of applying water. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. If this unit is used for hay and pasture, the main limitation is the low available water capacity.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation and the low available water capacity. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

7—Altvan-Dix complex, 6 to 10 percent slopes. This map unit is on undulating to rolling alluvial terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 55 percent Altvan loam and 30 percent Dix very gravelly sandy loam. The Altvan soil is on terrace remnants, and the Dix soil is on terrace escarpments. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon loam and Wages loam. Included areas make up about 15 percent of the total acreage.

The Altvan soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is dark grayish brown loam 9 inches thick. The upper 16 inches of the subsoil is dark brown sandy clay loam, and the lower 3 inches is brown sandy clay loam. The substratum to a depth of 60 inches or more is brown very gravelly sand.

Permeability of the Altvan soil is moderate to a depth of 28 inches and very rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Dix soil is deep and excessively drained. It formed in alluvium. Typically, the surface layer is very dark grayish brown very gravelly sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand.

Permeability of the Dix soil is rapid in the surface layer and very rapid below the surface layer. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is slight.

This unit is used as rangeland and for nonirrigated and irrigated crops.

The potential plant community on the Altvan soil is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation and the low available water capacity. The suitability of the soil for rangeland seeding is fair. The main limitation is the hazard of water erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Dix soil is mainly little bluestem, bluebunch wheatgrass, Indian ricegrass, and needleandthread. As the range condition deteriorates, blue grama and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation and the very low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are small stones and slope. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation, the restricted available water capacity, and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Maintaining crop residue upright by subsurface tillage reduces runoff, reduces wind erosion, and helps maintain soil tilth. Erosion can be reduced by using a management system that includes such practices as stubble mulching, limiting tillage for seedbed preparation and weed control, and constructing grassed waterways and diversions. Crops that are tolerant of drought are best suited because the available moisture is not adequate for good growth of most other crops.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Because the soils in this unit are droughty, applications of irrigation water should be light and frequent.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual

precipitation, the restricted available water capacity, and the droughtiness of the soils. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife. Areas used as cropland provide food for pheasant.

This map unit is in capability subclass IVe. The Altvan soil is in Loamy range site, 15- to 17-inch precipitation zone, and the Dix soil is in Gravelly range site, 15- to 17-inch precipitation zone.

8—Ascalon loam, 0 to 1 percent slopes. This deep, well drained soil is on plains. It formed in old alluvium derived from mixed sources. The native vegetation is mainly grasses and forbs.

Typically, the surface layer is dark brown loam 5 inches thick. The upper 16 inches of the subsoil is brown sandy clay loam, and the lower 17 inches is light yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown loam.

Included in this unit are small areas of Altvan loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIc, irrigated, and IIIc, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

9—Ascalon loam, 1 to 3 percent slopes. This deep, well drained soil is on plains. It formed in old alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loam 5 inches thick. The upper 16 inches of the subsoil is brown sandy clay loam, and the lower 17 inches is light yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown loam.

Included in this unit are small areas of Altvan loam and Wages loam on knolls. Included areas make up about 15 percent of the total acreage.

Permeability of this Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small

grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blüe grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is well suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

10—Ascalon loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on plains. It formed in old alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loam 5 inches thick. The upper 16 inches of the subsoil is brown sandy clay loam, and the lower 17 inches is light yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown loam.

Included in this unit are small areas of Altvan loam and Wages loam on knolls. Included areas make up about 15 percent of the total acreage.

Permeability of this Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, constructing diversions and grassed waterways, and keeping the surface rough and cloddy.

If this unit is used for irrigated crops, the main limitation is the hazard of erosion by wind and water. Sprinkler irrigation is suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with

undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of erosion by wind and water. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

11—Bayard fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 16 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Alice fine sandy loam on knolls and Vetal fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Bayard soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because permeability is moderately rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

12—Bayard fine sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on alluvial fans. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 16 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Alice fine sandy loam on knolls and Vetal fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Bayard soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of

erosion by wind and water. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips placed at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitations are slope and the hazard of water erosion. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. Maintaining crop residue on or near the surface reduces runoff, reduces wind and water erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IVe, nonirrigated, and IIIe, irrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

13—Bayard fine sandy loam, 6 to 10 percent slopes. This deep, well drained, sloping to rolling soil is on terraces and alluvial fans. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 16 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Alice fine sandy loam on knolls and Vetal fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Bayard soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used as rangeland. It can be used for nonirrigated crops if a management system for controlling wind and water erosion is applied. Erosion can be reduced by using a management system that includes such practices as constructing grassed waterways and diversions, stripcropping, stubble mulching, and limiting tillage for seedbed preparation and weed control.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of erosion by wind and water during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual

precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy range site, 15- to 17-inch precipitation zone.

14—Bayard Variant fine sandy loam, 0 to 3 percent slopes. This deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The upper 20 inches of the underlying material is very pale brown sandy loam, and the lower part to a depth of 60 inches or more is light gray sandy loam.

Included in this unit are small areas of Merden loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Bayard Variant soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating water table is at a depth of 30 to 60 inches. The soil occasionally is flooded for brief periods in summer.

This unit is used mainly for hay and pasture. It is also used as rangeland.

If this unit is used for hay and pasture, the main limitation is the hazard of flooding.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, little bluestem, and cottonwood. As the range condition deteriorates, woody species increase. As the range condition further deteriorates, Kentucky bluegrass, western ragweed, and annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation and the hazard of flooding. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of flooding. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

Water-tolerant vegetation, such as cottonwood and boxelder, provides important roosting and nesting places for resident and migratory birds of prey and provides habitat for wetland wildlife.

This map unit is in capability subclass IIIw, irrigated and nonirrigated. It is in Lowland range site, 15- to 17-inch precipitation zone.

15—Dix-Altvan complex, 10 to 30 percent slopes. This map unit is on moderately steep to steep, dissected alluvial terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 65 percent Dix very gravelly sandy loam that has slopes of 10 to 30 percent and 30 percent Altvan loam that has slopes of 10 to 15 percent. The Dix soil is on terrace escarpments, and the Altvan soil is on terrace remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon loam and Wages loam. Included areas make up about 5 percent of the total acreage.

The Dix soil is deep and excessively drained. It formed in gravelly, sandy alluvium. Typically, the surface layer is dark grayish brown very gravelly sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand.

Permeability of the Dix soil is rapid in the surface layer and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is slight. This soil is droughty.

The Altvan soil is very deep and well drained. It formed in loamy mixed alluvium. Typically, the surface layer is dark grayish brown loam 9 inches thick. The upper 16 inches of the subsoil is dark brown sandy clay loam, and the lower 3 inches is brown sandy clay loam. The substratum to a depth of 60 inches or more is brown very gravelly sand.

Permeability of the Altvan soil is moderate to a depth of 28 inches and very rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of wind erosion is moderate.

This unit is used as rangeland.

The potential plant community on the Dix soil is mainly little bluestem, bluebunch wheatgrass, Indian ricegrass, and needleandthread. As the range condition

deteriorates, blue grama and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years.

The production of forage on this soil is limited by the very low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are small stones and slope. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Altvan soil is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation and the low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitation is the hazard of erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are low annual precipitation, droughtiness of the Dix soil, and slope.

Areas of this unit not used by livestock are well suited to wildlife habitat. The vegetation produced on the unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe. The Dix soil is in Gravelly range site, 15- to 17-inch precipitation zone, and the Altvan soil is in Loamy range site, 15- to 17-inch precipitation zone.

16—Dix-Otero complex, 6 to 10 percent slopes. This map unit is on undulating to rolling, dissected alluvial terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 45 percent Dix very gravelly sandy loam and 40 percent Otero fine sandy loam. The Dix soil is on terrace escarpments, and the Otero soil is on terrace remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayard fine sandy loam and Vetal fine sandy loam in low-lying areas. Included areas make up about 15 percent of the total acreage.

The Dix soil is deep and excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark grayish brown very gravelly sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand.

Permeability of the Dix soil is rapid in the surface layer and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is slight. This soil is droughty.

The Otero soil is deep and well drained. It formed in calcareous alluvium derived from mixed sources. Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper 35 inches of the underlying material is yellowish brown fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Permeability of the Otero soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. This soil is highly calcareous throughout.

This unit is used as rangeland.

The potential plant community on the Dix soil is mainly little bluestem, bluebunch wheatgrass, Indian ricegrass, and needleandthread. As the range condition deteriorates, blue grama and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years.

The production of forage on this soil is limited by the very low available water capacity. Rangeland seeding is suitable if the range is in poor condition. The main limitation is small stones. Areas that are heavily infested

with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Otero soil is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation. The suitability of the soil for rangeland seeding is fair. The main limitation is the hazard of erosion by wind and water during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are low annual precipitation and the hazard of wind erosion and droughtiness of the Dix soil.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIs. The Dix soil is in Gravelly range site, 15- to 17-inch precipitation zone, and the Otero soil is in Sandy range site, 15- to 17-inch precipitation zone.

17—Jayem fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on uplands. It formed in sediment derived dominantly from noncalcareous sandstone. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 15 inches thick. The upper 7 inches of the subsoil is brown fine sandy loam, and the lower 18 inches is yellowish brown fine sandy loam. The substratum to a depth of 60 inches or more is yellowish brown sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam on knolls. Included areas make up about 15 percent of the total acreage.

Permeability of this Jayem soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because the permeability is moderately rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or

sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

18—Jayem fine sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on uplands. It formed in sediment derived dominantly from noncalcareous sandstone. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 15 inches thick. The upper 7 inches of subsoil is brown fine sandy loam, and the lower 18 inches is yellowish brown fine sandy loam. The substratum to a depth of 60 inches or more is yellowish brown sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam on knolls. Included areas make up about 15 percent of the total acreage.

Permeability of this Jayem soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, and constructing diversions and grassed waterways. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

19—Manter sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on fans and terraces. It formed in eolian material derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown sandy loam 7 inches thick. The upper 5 inches of the subsoil is brown fine sandy loam, and the lower 13 inches is pale brown fine sandy loam. The substratum to a depth of 60 inches or more is very pale brown sandy loam.

Included in this unit are small areas of Bayard fine sandy loam on knolls and Jayem fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Manter soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly as rangeland. It is also used for nonirrigated crops.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because the permeability is rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. This unit is well suited to hay and pasture.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

20—Manter sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on fans and terraces. It formed in eolian material derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown sandy loam 7 inches thick. The upper 5 inches of the subsoil is brown fine sandy loam, and the lower 13 inches is pale brown fine sandy loam. The substratum to a depth of 60 inches or more is very pale brown sandy loam.

Included in this unit are small areas of Bayard fine sandy loam on knolls and Jayem fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Manter soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly as rangeland. It is also used for nonirrigated crops.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase water infiltration, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitation is the hazard of water erosion. Erosion can be reduced by using a management system that includes

such practices as constructing grassed waterways, stripcropping, stubble mulching, and limiting tillage for seedbed preparation and weed control.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclasses IVe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

21—Manter sandy loam, 6 to 10 percent slopes. This deep, well drained, sloping to undulating soil is on fans and terraces. It formed in eolian material derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown sandy loam 7 inches thick. The upper 5 inches of the subsoil is brown fine sandy loam, and the lower 13 inches is pale brown fine sandy loam. The substratum to a depth of 60 inches or more is very pale brown sandy loam.

Included in this unit are small areas of Bayard fine sandy loam on knolls and Jayem fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Manter soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of erosion by wind and water during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of erosion by wind and water. Precipitation is not sufficient for annual cropping. Erosion can be reduced by using a management system that includes such practices as constructing grassed waterways, stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, and seeding to permanent vegetation.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe and in Sandy range site, 15- to 17-inch precipitation zone.

22—Manter Variant fine sandy loam, 0 to 3 percent slopes. This shallow, well drained, gently sloping to undulating soil is on uplands. It formed in material derived dominantly from noncalcareous sandstone. The native vegetation is mainly forbs, grasses, and shrubs.

Typically, the surface layer is grayish brown sandy loam 4 inches thick. The subsoil is dark brown fine sandy loam 7 inches thick. Soft sandstone is at a depth of about 11 inches. Depth to sandstone ranges from 10 to 20 inches.

Included in this unit are small areas of Manter sandy loam on the edge of terraces and Valent loamy fine sand in swales. Also included are small areas of Manter Variant fine sandy loam, along the Colorado state line, that has slopes of 3 to 6 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this Manter Variant soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years.

Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by shallow soil depth and the low available water capacity. The suitability of the unit for rangeland seeding is poor. The main limitations are shallow soil depth and the hazard of erosion by wind and water during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is poorly suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IVs and in Shallow Sandy range site, 15- to 17-inch precipitation zone.

23—Merden loam, 0 to 3 percent slopes. This deep, poorly drained soil is on flood plains and in drainageways. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark grayish brown loam 20 inches thick. The underlying material to a depth of 60 inches or more is gray loam. In some areas the surface layer is very fine sandy loam.

Included in this unit are small areas of Merden Variant silty clay loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Merden soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is slight. This soil is subject to periods of flooding in spring. A water table is at a depth of less than 18 inches to 36 inches during the growing season. This soil is strongly alkaline.

This unit is used mainly for hay and pasture. It is also used as rangeland.

If this unit is used for hay and pasture, the main limitations are wetness and strong alkalinity. Species that tolerate wetness and strong alkalinity should be seeded. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and protect the soil from erosion.

The potential plant community on this unit is mainly alkali sacaton, western wheatgrass, inland saltgrass, and switchgrass. As the range condition deteriorates, inland saltgrass increases. As the range condition further deteriorates, annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 4,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,500 pounds in favorable years to 3,000 pounds in unfavorable years.

The production of forage on this unit is limited by strong alkalinity, wetness, and the hazard of flooding. The suitability of the unit for rangeland seeding is fair. The main limitations are strong alkalinity and wetness.

If this unit is used for windbreaks and environmental plantings, the main limitations are wetness and strong alkalinity. Only windbreaks that tolerate wetness and alkalinity should be planted.

The vegetation produced on this unit provides important habitat for wetland wildlife.

This map unit is in capability subclass IIIw, nonirrigated and irrigated. It is in Saline Subirrigated range site, 15- to 17-inch precipitation zone.

24—Merden Variant silty clay loam, 0 to 3 percent slopes. This deep, poorly drained soil is on flood plains and along drainageways. It formed in alluvium derived dominantly from siltstone. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is grayish brown silty clay loam 10 inches thick. The upper 15 inches of the underlying material is light gray silty clay loam, the next 22 inches is white silty clay loam, and the lower part to a depth of 60 inches or more is light gray silty clay loam. The soil is highly calcareous throughout. In some areas the surface layer is silt loam.

Included in this unit are small areas of Merden loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Merden Variant soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is slight. This soil is strongly alkaline. It is subject to occasional, brief periods of flooding. A fluctuating water table is at a depth of 12 to 36 inches.

This unit is used as rangeland.

The potential plant community on this unit is mainly alkali sacaton, western wheatgrass, inland saltgrass, and switchgrass. As the range condition deteriorates, inland saltgrass increases. As the range condition further deteriorates, annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 4,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,500 pounds in favorable years to 3,000 pounds in unfavorable years.

The production of forage on this unit is limited by strong alkalinity, wetness, and the hazard of flooding.

The suitability of the unit for rangeland seeding is fair. The main limitations are strong alkalinity and wetness. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

If this unit is used for windbreaks and environmental plantings, the main limitations are wetness and strong alkalinity. Only windbreaks that tolerate wetness and alkalinity should be planted.

The vegetation produced on this unit provides important habitat for wetland wildlife.

This map unit is in capability subclass IIIw, irrigated and nonirrigated. It is in Saline Subirrigated range site, 15- to 17-inch precipitation zone.

25—Mitchell very fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans and terraces. It formed in calcareous alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown very fine sandy loam 3 inches thick. The upper 11 inches of the underlying material is brown silt loam, the next 19 inches is yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Ascalon loam and Nucla fine sandy loam in swales. Included areas make up about 15 percent of the total acreage.

Permeability of this Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate. The soil is highly calcareous throughout.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of erosion by wind and water. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

26—Mitchell very fine sandy loam, 3 to 6 percent slopes. This deep, well drained soil is on alluvial fans and terraces. It formed in calcareous alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown very fine sandy loam 3 inches thick. The upper 11 inches of the underlying material is brown silt loam, the next 19 inches is yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Ascalon loam and Nucla fine sandy loam in swales. Included areas make up about 10 percent of the total acreage.

Permeability of this Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate. The soil is highly calcareous throughout.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of erosion by wind and water. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, and constructing diversions and grassed waterways. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

27—Mitchell very fine sandy loam, 6 to 10 percent slopes. This deep, well drained soil is on undulating alluvial fans and terraces. It formed in calcareous alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown very fine sandy loam 3 inches thick. The upper 11 inches of the underlying material is brown silt loam, the next 19 inches is yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Ascalon loam and Nucla fine sandy loam in swales. Included areas make up about 10 percent of the total acreage.

Permeability of this Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of wind erosion is moderate. The soil is highly calcareous throughout.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of water erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe and in Loamy range site, 15- to 17-inch precipitation zone.

28—Mitchell Variant-Tassel Variant fine sandy loams, 0 to 3 percent slopes. This map unit is on

uplands. It consists of soils that have been altered by land leveling operations designed to enhance the production of irrigated alfalfa, for which the unit is no longer used.

This unit is 55 percent Mitchell Variant fine sandy loam and 35 percent Tassel Variant fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayard fine sandy loam and Otero fine sandy loam. Included areas make up about 10 percent of the total acreage.

The Mitchell Variant soil is moderately deep and well drained. It formed in silty calcareous alluvium. Typically, the surface layer is brown fine sandy loam 3 inches thick. The upper 14 inches of the underlying material is brown sandy loam, the next 8 inches is yellowish brown silt loam, and the lower 7 inches is pale brown silt loam. Siltstone is at a depth of 32 inches. Depth to siltstone ranges from 25 to 40 inches.

Permeability of this Mitchell Variant soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. This soil is strongly alkaline.

The Tassel Variant soil is shallow and well drained. It formed in silty calcareous alluvium. Typically, the surface layer is very pale brown silt loam 5 inches thick. The underlying material is very pale brown silt loam 10 inches thick. Siltstone is at a depth of 15 inches. Depth to siltstone ranges from 10 to 20 inches.

Permeability of this Tassel Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 11 to 17 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is strongly alkaline.

This unit is used for pasture, but production is limited by depth to bedrock and strong alkalinity. If the pasture is improved, this unit can provide important habitat for openland wildlife.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are depth to bedrock and strong alkalinity.

This map unit is in capability subclass VIs. It is not placed in a range site.

29—Nucla fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans. It formed in calcareous loamy alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown fine sandy loam 2 inches thick. The subsoil is brown loam 12 inches thick. The upper 18 inches of the substratum is light yellowish brown loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is very fine sandy loam.

Included in this unit are small areas of Ascalon loam on uplands and Mitchell very fine sandy loam on fans. Included areas make up about 15 percent of the total acreage.

Permeability of this Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be

irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

30—Nucla fine sandy loam, 3 to 6 percent slopes. This deep, well drained soil is on alluvial fans. It formed in calcareous loamy alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown fine sandy loam 2 inches thick. The subsoil is brown loam 12 inches thick. The upper 18 inches of the substratum is light yellowish brown loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is very fine sandy loam.

Included in this unit are small areas of Ascalon loam on uplands and Mitchell very fine sandy loam on the edge of fans. Included areas make up about 15 percent of the total acreage.

Permeability of this Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, constructing diversions and grassed waterways, and maintaining a rough and cloddy surface.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and in Loamy range site, 15- to 17-inch precipitation zone.

31—Nucla-Mitchell fine sandy loams, 0 to 3 percent slopes. This map unit is on alluvial fans and terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 45 percent Nucla fine sandy loam and 35 percent Mitchell fine sandy loam. The Nucla soil is on fans, and the Mitchell soil is on terrace remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon and Wages soils. Included areas make up about 20 percent of the total acreage.

The Nucla soil is deep and well drained. It formed in loamy calcareous alluvium derived from mixed sources. Typically, the surface layer is brown fine sandy loam 2 inches thick. The subsoil is brown loam 12 inches thick. The upper 18 inches of the substratum is light yellowish brown loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam.

Permeability of the Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

The Mitchell soil is deep and well drained. It formed in silty calcareous alluvium. Typically, the surface layer is

brown fine sandy loam 3 inches thick. The upper 11 inches of the underlying material is brown silt loam, the next 19 inches is yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

Permeability of the Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. The soil is highly calcareous throughout.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

32—Nucla-Mitchell fine sandy loams, 3 to 6 percent slopes. This map unit is on gently sloping to undulating alluvial fans and terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 45 percent Nucla fine sandy loam and 35 percent Mitchell fine sandy loam. The Nucla soil is on fans, and the Mitchell soil is on terrace remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon and Wages soils. Included areas make up about 20 percent of the total acreage.

The Nucla soil is deep and well drained. It formed in loamy calcareous alluvium derived from mixed sources. Typically, the surface layer is brown fine sandy loam 2 inches thick. The subsoil is brown loam 12 inches thick. The upper 18 inches of the substratum is light yellowish brown loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam.

Permeability of the Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Mitchell soil is deep and well drained. It formed in silty calcareous alluvium. Typically, the surface layer is brown fine sandy loam 3 inches thick. The upper 11 inches of the underlying material is brown silt loam, the next 19 inches is yellowish brown silt loam, and the lower part to a depth of 60 inches or more is pale brown loam.

Permeability of the Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high. The soil is highly calcareous throughout.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and

maintaining crop residue on the surface. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. Erosion can be reduced by using a management system that includes such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, and constructing grassed waterways. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is suited to windbreaks and environmental plantings. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

33—Otero fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans. It formed in calcareous alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper 35 inches of the underlying material is yellowish brown fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam in swales. Included areas make up about 10 percent of the total acreage.

Permeability of this Otero soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. The soil is highly calcareous throughout.

This unit is used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because the water intake rate is rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low soil fertility. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IVe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

34—Otero fine sandy loam, 3 to 6 percent slopes. This deep, well drained soil is on gently sloping to undulating alluvial fans and terraces. It formed in calcareous alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper 35 inches of the underlying material is yellowish brown fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam in swales. Included areas make up about 10 percent of the total acreage.

Permeability of this Otero soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high. The soil is highly calcareous throughout.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of erosion by wind and water. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Tillage should be kept to a minimum.

If this unit is used for irrigated crops, the main limitation is slope. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low soil fertility. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

35—Otero fine sandy loam, 6 to 10 percent slopes. This deep, well drained, moderately sloping to rolling soil is on alluvial fans. It formed in calcareous alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper 35 inches of the underlying material is yellowish brown fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam in swales. Included areas make up about 10 percent of the total acreage.

Permeability of this Otero soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard

of water erosion is high. The hazard of wind erosion is high. The soil is highly calcareous throughout.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of erosion by wind and water during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low soil fertility. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe and in Sandy range site, 15- to 17-inch precipitation zone.

36—Paoli fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on low terraces. It formed in calcareous alluvium derived from mixed sources. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The layer below that is dark brown fine sandy loam about 31 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Vetal fine sandy loam. Also included are small areas of Paoli fine sandy loam, along the Colorado state line, which has slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Paoli soil is rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is suited to windbreaks and environmental plantings. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IIIe and in Sandy range site, 15- to 17-inch precipitation zone.

37—Tassel-Otero-Rock outcrop complex, 10 to 30 percent slopes. This map unit is on moderately steep to hilly terraces and escarpments. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 40 percent Tassel fine sandy loam, 30 percent Otero fine sandy loam, and 20 percent Rock outcrop. The Tassel soil is on the crests of ridges, the Otero soil is on the edge of terraces, and Rock outcrop is on escarpments. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Valent loamy fine sand in swales. Included areas make up about 10 percent of the total acreage.

The Tassel soil is shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam 6 inches thick. The underlying material is pale brown fine sandy loam 6 inches thick. Soft

sandstone is at a depth of 12 inches. Depth to sandstone ranges from 6 to 20 inches.

Permeability of the Tassel soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 6 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

The Otero soil is deep and well drained. It formed in calcareous alluvium derived from mixed sources. Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper 35 inches of the underlying material is yellowish brown fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown fine sandy loam.

Permeability of this Otero soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of wind erosion is high. The soil is highly calcareous throughout.

Rock outcrop consists of areas of exposed calcareous sandstone.

This unit is used as rangeland.

The potential plant community on the Tassel soil is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this soil is limited by shallow soil depth and the very low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are shallow soil depth and the hazard of erosion by wind and water during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Otero soil is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation. The suitability of the soil for rangeland seeding is poor. The main limitation is the hazard of erosion by wind and water during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

Slope and the areas of Rock outcrop may limit access by livestock and encourage overgrazing of the less sloping areas of this unit.

This unit provides good habitat for mule deer and other rangeland wildlife.

This map unit is in capability subclass VIs. The Tassel soil is in Shallow Sandy range site, 15- to 17-inch precipitation zone, and the Otero soil is in Sandy range site, 15- to 17-inch precipitation zone.

38—Tassel, thin solum-Tassel-Rock outcrop complex, 10 to 30 percent slopes. This map unit is on low hills and in steep areas on ridges. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 40 percent Tassel fine sandy loam, thin solum, 35 percent Tassel fine sandy loam, and 20 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Otero fine sandy loam. Included areas make up about 5 percent of the total acreage.

The Tassel fine sandy loam, thin solum, is very shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam 4 inches thick. The underlying material is brown loam 5 inches thick. Soft sandstone is at a depth of 9 inches. Depth to sandstone ranges from 6 to 10 inches.

Permeability of the Tassel fine sandy loam, thin solum, is moderately rapid. Available water capacity is very low. Effective rooting depth is 6 to 10 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

The Tassel fine sandy loam is shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam 6 inches thick. The underlying material is pale brown fine sandy loam 6 inches thick. Soft sandstone is at a depth of 12 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Tassel fine sandy loam is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is

medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

Rock outcrop consists of areas of exposed calcareous sandstone.

This unit is used as rangeland.

The potential plant community on the Tassel fine sandy loam, thin solum, is mainly bluebunch wheatgrass, little bluestem, Indian ricegrass, and needleandthread. As the range condition deteriorates, forbs and juniper increase. As the range condition further deteriorates, broom snakeweed, annual grasses, and forbs invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 600 pounds in favorable years to 300 pounds in unfavorable years.

The production of forage on this soil is limited by very shallow soil depth and the very low available water capacity. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Tassel fine sandy loam is mainly little bluestem, needleandthread; western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this soil is limited by shallow soil depth and the very low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are shallow soil depth and the hazard of erosion by wind and water during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

Slope and the areas of Rock outcrop may limit access by livestock and encourage overgrazing of the less sloping areas of this unit.

This unit provides good habitat for mule deer and other rangeland wildlife.

This map unit is in capability subclass VIIs. The Tassel fine sandy loam, thin solum, is in Very Shallow range site, 15- to 17-inch precipitation zone, and the Tassel fine sandy loam is in Shallow Sandy range site, 15- to 17-inch precipitation zone.

39—Treon fine sandy loam, 6 to 10 percent slopes. This shallow, well drained, sloping to rolling soil is on uplands. It formed in calcareous material derived from fine grained sandstone.

Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The underlying material is pale brown sandy loam 4 inches thick. Soft sandstone is at a depth of 14 inches. Depth to sandstone ranges from 10 to 20 inches. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam on knolls and Vetal fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Treon soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated crops. It is also used for irrigated crops.

This unit is poorly suited to nonirrigated crops. The main limitations are the low available water capacity, depth to rock, and slope. Erosion can be reduced by using a management system that includes such practices as stubble mulching, constructing grassed waterways and diversions, stripcropping, limiting tillage for seedbed preparation and weed control, and seeding to permanent vegetation.

This unit is poorly suited to irrigated crops. The main limitations are the low available water capacity, the hazard of water erosion, depth to rock, and slope. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Maintaining crop residue upright by subsurface tillage reduces runoff, reduces wind erosion, and helps maintain soil tilth. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

If this unit is used for windbreaks and environmental plantings, the main limitations are depth to rock and the hazard of wind erosion. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. It is not placed in a range site.

40—Treon-Aberone-Treon, thin solum, fine sandy loams, 6 to 15 percent slopes. This map unit is on

moderately steep to rolling hills, uplands, and terraces. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 40 percent Treon fine sandy loam that has slopes of 6 to 15 percent, 35 percent Aberone fine sandy loam that has slopes of 10 to 15 percent, and 20 percent Treon, thin solum, fine sandy loam that has slopes of 6 to 15 percent. The Treon fine sandy loam is on hillsides, the Aberone fine sandy loam is on the edge of terraces, and the Treon, thin solum, fine sandy loam is on knolls and ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Vetal fine sandy loam. Included areas make up about 5 percent of the total acreage.

The Treon fine sandy loam is shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The underlying material is pale brown fine sandy loam 4 inches thick. Soft sandstone is at a depth of 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of this Treon soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of wind erosion is high.

The Aberone fine sandy loam is deep and well drained. It formed in calcareous alluvium. Typically, the surface layer is brown fine sandy loam 5 inches thick. The subsoil is brown sandy loam 13 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown very gravelly sandy loam.

Permeability of this Aberone soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

The Treon, thin solum, fine sandy loam is very shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is dark brown fine sandy loam 3 inches thick. The underlying material is dark brown fine sandy loam 7 inches thick. Soft sandstone is at a depth of 10 inches. Depth to sandstone ranges from 6 to 10 inches.

Permeability of this Treon, thin solum, soil is moderately rapid. Available water capacity is very low. Runoff is medium, and the hazard of water erosion is high. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on the Treon fine sandy loam is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years. The production of forage on this soil is limited by shallow soil depth and the very low available water capacity.

The potential plant community on the Aberone soil is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years. The production of forage on this soil is limited by low annual precipitation.

The potential plant community on the Treon, thin solum, fine sandy loam is mainly bluebunch wheatgrass, little bluestem, Indian ricegrass, and needleandthread. As the range condition deteriorates, forbs and junipers increase. As the range condition further deteriorates, broom snakeweed, annual grasses, and forbs invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 600 pounds in favorable years to 300 pounds in unfavorable years. The production of forage on this soil is limited by very shallow soil depth and the very low available water capacity.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Steepness of slope in some areas limits access by livestock and encourages overgrazing of the less sloping areas. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The suitability of the unit for rangeland seeding is poor. The main limitations are the very shallow and shallow depth of the Treon soils and the hazard of erosion by wind and water during the period of seedling establishment.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe. The Treon fine sandy loam is in Shallow Sandy range site, 15- to

17-inch prcipitation zone; the Aberone fine sandy loam is in Sandy range site, 15- to 17-inch precipitation zone; and the Treon, thin solum, fine sandy loam is in Very Shallow range site, 15- to 17-inch precipitation zone.

41—Treon, thin solum-Rock outcrop-Treon complex, 15 to 30 percent slopes. This map unit is on hills and escarpments. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 40 percent Treon, thin solum, fine sandy loam, 35 percent Rock outcrop, and 20 percent Treon fine sandy loam. The Treon, thin solum, fine sandy loam is on hilltops, the Rock outcrop is on escarpments, and the Treon fine sandy loam is on hillsides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Otero fine sandy loam. Included areas make up about 5 percent of the total acreage.

The Treon, thin solum, fine sandy loam is very shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is dark brown fine sandy loam 3 inches thick. The underlying material is dark brown fine sandy loam 7 inches thick. Soft sandstone is at a depth of 10 inches. Depth to sandstone ranges from 6 to 10 inches.

Permeability of the Treon, thin solum, fine sandy loam is moderately rapid to a depth of 10 inches and very slow below this depth. Available water capacity is very low. Effective rooting depth is 6 to 10 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of wind erosion is high.

The Treon fine sandy loam is shallow and well drained. It formed in calcareous material derived dominantly from sandstone. Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The underlying material is pale brown fine sandy loam 4 inches thick. Soft sandstone is at a depth of 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Treon fine sandy loam is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of wind erosion is high.

Rock outcrop consists of areas of exposed calcareous sandstone.

This unit is used as rangeland.

The potential plant community on the Treon, thin solum, fine sandy loam is mainly bluebunch wheatgrass, little bluestem, Indian ricegrass, and needleandthread. As the range condition deteriorates, forbs and juniper increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 600 pounds in favorable years to 300 pounds in unfavorable years.

The potential plant community on the Treon fine sandy loam is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by the very shallow and shallow soil depth and by the very low available water capacity. Steepness of slope and the areas of Rock outcrop may limit access by livestock and encourage overgrazing of the less sloping areas. The suitability of the unit for rangeland seeding is poor. The main limitations are the very low available water capacity and the areas of Rock outcrop. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The Treon soils are well suited to habitat for rangeland wildlife. They provide good habitat for mule deer.

This map unit is in capability subclass VIIs. The Treon, thin solum, fine sandy loam is in Very Shallow range site, 15- to 17-inch precipitation zone, and the Treon fine sandy loam is in Shallow Sandy range site, 15- to 17-inch precipitation zone.

42—Valent loamy fine sand, 0 to 6 percent slopes. This deep, excessively drained, nearly level to undulating soil is on plains. It formed in eolian sand. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the soil is brown and pale brown loamy fine sand to a depth of 60 inches or more.

Included in this unit are small areas of Otero fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Valent soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. The soil is droughty.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and

annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation and the low available water capacity. The suitability of the unit for rangeland seeding is poor. The main limitations are the hazard of wind erosion and droughtiness. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation, droughtiness, and the hazard of wind erosion. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe and in Sandy range site, 15- to 17-inch precipitation zone.

43—Valent loamy fine sand, rolling. This deep, excessively drained soil is on plains. It formed in eolian sand. Slope is 6 to 16 percent. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the soil is brown and pale brown loamy fine sand to a depth of 60 inches or more.

Included in this unit are small areas of Otero fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Valent soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. This soil is droughty.

This unit is used as rangeland.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, and Indian ricegrass. As the range condition deteriorates, blue grama, green sagewort, and sand sagebrush increase. As the range condition further deteriorates, annuals invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,500 pounds of air-dry vegetation per acre in normal years. Production varies from 2,000 pounds in favorable years to 900 pounds in unfavorable years.

The production of forage on this unit is limited by the hazard of wind erosion and the low available water capacity. The suitability of the unit for rangeland seeding is poor. The main limitations are droughtiness, the hazard of wind erosion, and slope. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation, droughtiness, and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIIe and in Sandy range site, 15- to 17-inch precipitation zone.

44—Valent-Treon complex, 6 to 10 percent slopes. This map unit is on sloping to rolling uplands. The native vegetation is mainly grasses, forbs, and shrubs.

This unit is 50 percent Valent loamy fine sand and 35 percent Treon fine sandy loam. The Valent soil is on rolling plains, and the Treon soil is on ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Aberone, Vetal, and Tassel fine sandy loams. Included areas make up about 15 percent of the total acreage.

The Valent soil is deep and excessively drained. It formed in eolian sand. Typically, the soil is brown and pale brown loamy fine sand to a depth of 60 inches or more.

Permeability of the Valent soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high. This soil is droughty.

The Treon soil is shallow and well drained. It formed in material derived from calcareous sandstone. Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The underlying material is pale brown fine sandy loam 4 inches thick. Sandstone is at a depth of 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Treon soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate. This soil is droughty.

This unit is used as rangeland.

The potential plant community on the Valent soil is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock

grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this soil is limited by low annual precipitation and the low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are the hazard of wind erosion and droughtiness. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on the Treon soil is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge, blue grama, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed, curlycup gumweed, milkweed, and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this soil is limited by shallow soil depth and the very low available water capacity. The suitability of the soil for rangeland seeding is poor. The main limitations are shallow soil depth and the hazard of erosion by wind and water during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass VIe. The Valent soil is in Sandy range site, 15- to 17-inch precipitation zone, and the Treon soil is in Shallow Sandy range site, 15- to 17-inch precipitation zone.

45—Vetal loamy fine sand, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loamy fine sand 10 inches thick. The upper 17 inches of the underlying material is dark brown fine sandy loam, and the lower part to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Bayard fine sandy loam and Paoli fine sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Vetal soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of wind erosion during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IIIe and in Sandy range site, 15- to 17-inch precipitation zone.

46—Vetal loamy fine sand, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on alluvial fans. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loamy fine sand 10 inches thick. The upper 17 inches of the underlying material is dark brown fine sandy loam, and the lower part to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Bayard fine sandy loam and Otero fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Vetal soil is moderately rapid. Available water capacity is high. Effective rooting depth

is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is fair. The main limitation is the hazard of wind erosion during the period of seedling establishment. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are low annual precipitation and the hazard of wind erosion. Wind erosion can be reduced by cultivating only in the rows of windbreaks and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The vegetation produced on this unit provides important habitat for rangeland wildlife.

This map unit is in capability subclass IIIe and in Sandy range site, 15- to 17-inch precipitation zone.

47—Vetal fine sandy loam, 0 to 1 percent slopes. This deep, well drained soil is on low terraces. It formed in alluvium.

Typically, the surface layer is dark brown fine sandy loam 27 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam and Paoli fine sandy loam on the edge of terraces. Included areas make up about 10 percent of the total acreage.

Permeability of this Vetal soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at right angles to the prevailing wind and by maintaining crop residue on the surface. Maintaining crop residue upright by subsurface tillage reduces runoff, reduces wind erosion, and helps maintain soil tilth. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because permeability is moderately rapid, sprinkler irrigation is best suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

This unit is suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The cropland vegetation produced on this unit provides food for openland wildlife.

This map unit is in capability subclasses IIc, irrigated, and IIIc, nonirrigated. It is not placed in a range site.

48—Vetal fine sandy loam, 1 to 3 percent slopes. This deep, well drained soil is on low terraces. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 27 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam and Paoli fine sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Vetal soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Wind erosion can be controlled by stripcropping with narrow strips at

right angles to the prevailing wind and by maintaining crop residue on the surface. Maintaining crop residue upright by subsurface tillage reduces runoff, reduces wind erosion, and helps maintain soil tilth. Tillage should be kept to a minimum.

This unit is well suited to irrigated crops. Because permeability is moderately rapid, sprinkler irrigation is best suited to the unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

49—Vetal fine sandy loam, 3 to 6 percent slopes. This deep, well drained, gently sloping to undulating soil is on fans and terraces. It formed in alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown fine sandy loam 27 inches thick. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In some areas the surface layer is loamy fine sand.

Included in this unit are small areas of Bayard fine sandy loam and Paoli fine sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Vetal soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is high.

This unit is used mainly for nonirrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of wind erosion. Erosion can be reduced by using such practices as stripcropping, stubble mulching, limiting tillage for seedbed preparation and weed control, and constructing diversions and grassed waterways. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Maintaining crop residue upright by subsurface tillage reduces runoff, reduces wind erosion, and helps maintain soil tilth.

If this unit is used for irrigated crops, the main limitations are the hazard of water erosion and slope. Because of the slope, sprinkler or drip irrigation is most suitable for row crops. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Maintaining crop residue on or near the surface reduces runoff, reduces wind erosion, and helps maintain soil tilth and organic matter content. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, forbs and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,800 pounds in favorable years to 800 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good. The main limitation is the

hazard of wind erosion during the period of seedling establishment.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the more desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of wind erosion and low annual precipitation. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from flooding. The areas between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in Sandy range site, 15- to 17-inch precipitation zone.

50—Wages loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial fans and terraces. It formed in mixed alluvium. The native vegetation is mainly grasses, forbs, and shrubs.

Typically, the surface layer is dark brown loam 4 inches thick. The upper 3 inches of the subsoil is dark brown clay loam, and the lower 6 inches is yellowish brown clay loam. The upper 7 inches of the substratum is light yellowish brown loam, and the lower part to a depth of 60 inches or more is very pale brown gravelly sandy loam.

Included in this unit are small areas of Ascalon loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Wages soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low annual precipitation and the hazard of erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Practices that can be used to control erosion include seeding early in fall, using stubble-mulch tillage, and constructing terraces, diversions, and grassed waterways. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. All tillage should be on the contour or across the slope. Wind erosion can be controlled by keeping the surface rough and cloddy, stripcropping at right angles to the prevailing wind, and maintaining crop residue on the surface.

This unit is well suited to irrigated crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Grain and grasses respond to nitrogen, legumes respond to phosphorus, and potatoes respond to nitrogen, phosphorus, and potassium. This unit is well suited to hay and pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, blue grama, and little bluestem. As the range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase. As the range condition further deteriorates, broom snakeweed and annual grasses invade. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,900 pounds in favorable years to 700 pounds in unfavorable years.

The production of forage on this unit is limited by low annual precipitation. The suitability of the unit for rangeland seeding is good.

Practices such as chiseling can be used to improve areas of deteriorated rangeland. These practices increase the water intake rate, reduce plant competition, and allow the desirable native plants to increase. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

This unit is well suited to windbreaks and environmental plantings. The year prior to planting windbreaks, areas of cropland should be summer-fallowed and protected from erosion. The soil between the rows of windbreaks should be cultivated or sprayed to reduce weed competition. Windbreaks should be irrigated if water is available. Drip irrigation systems are suitable.

The vegetation produced on this unit provides important habitat for openland wildlife.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in Loamy range site, 15- to 17-inch precipitation zone.

prime farmland

Prime farmland, as defined by the United States Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It must either be used for producing food or fiber or be available for these uses. It has the soil quality, length of growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is managed properly. Prime farmland produces the highest yields with minimal energy and economic resources, and farming it results in the least disturbance of the environment.

Prime farmland commonly has an adequate and dependable supply of moisture from precipitation or irrigation. It also has a favorable temperature and length of growing season and an acceptable level of acidity or alkalinity. It has few if any rock fragments and is permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods and is not flooded during the growing season. The slope is no more than 6 percent.

Because of the semiarid climate of the survey area, only soils that have a dependable supply of irrigation water meet the criteria for prime farmland as defined above. Irrigated areas are scattered throughout the survey area, but most are in general map units 2, 3, 4, 5, and 10.

A recent trend in land use in some parts of the survey area has been the loss of some areas of prime farmland to industrial and urban uses. This puts pressure on marginal areas, which generally are more erodible, droughty, and difficult to cultivate and generally are less productive.

The following map units meet the requirements for prime farmland if irrigated. This list does not constitute a recommendation for a particular land use. The extent of each map unit is given in table 4. The location is shown on the detailed soil maps in the back of this publication. The qualities of the soils that affect use and management are described in the section "Detailed soil map units."

1 Albinas loam, 0 to 1 percent slopes
2 Albinas loam, 1 to 3 percent slopes
3 Alice fine sandy loam, 0 to 3 percent slopes
4 Alice fine sandy loam, 3 to 6 percent slopes
5 Altvan loam, 0 to 3 percent slopes
6 Altvan loam, 3 to 6 percent slopes
8 Ascalon loam, 0 to 1 percent slopes
9 Ascalon loam, 1 to 3 percent slopes
10 Ascalon loam, 3 to 6 percent slopes
11 Bayard fine sandy loam, 0 to 3 percent slopes
12 Bayard fine sandy loam, 3 to 6 percent slopes
17 Jayem fine sandy loam, 0 to 3 percent slopes
18 Jayem fine sandy loam, 3 to 6 percent slopes
19 Manter sandy loam, 0 to 3 percent slopes
20 Manter sandy loam, 3 to 6 percent slopes
25 Mitchell very fine sandy loam, 0 to 3 percent slopes
26 Mitchell very fine sandy loam, 3 to 6 percent slopes
29 Nucla fine sandy loam, 0 to 3 percent slopes
30 Nucla fine sandy loam, 3 to 6 percent slopes
31 Nucla-Mitchell fine sandy loams, 0 to 3 percent slopes
32 Nucla-Mitchell fine sandy loams, 3 to 6 percent slopes
33 Otero fine sandy loam, 0 to 3 percent slopes
34 Otero fine sandy loam, 3 to 6 percent slopes
35 Paoli fine sandy loam, 0 to 3 percent slopes
47 Vetal fine sandy loam, 0 to 1 percent slopes
48 Vetal fine sandy loam, 1 to 3 percent slopes
49 Vetal fine sandy loam, 3 to 6 percent slopes
50 Wages loam, 0 to 3 percent slopes

use and management of the soils

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

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

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

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

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

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

crops and pasture

William E. Warren, district conservationist, Soil Conservation Service, helped write this section.

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

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

In the following paragraphs is a discussion of the use and management of the nonirrigated and irrigated farmland in the survey area.

Nonirrigated cropland.—Most of the nonirrigated farmland in the survey area is used for winter wheat. Because of the semiarid climate, this land is summer-fallowed for one season and wheat is grown the next. About 231,000 acres of nonirrigated cropland is in the survey area, and of this about 115,000 acres is used for crops each year. The yields vary from year to year because of the wide variation in the amount of moisture available. Winter wheat yields vary from about 12 bushels per acre to 45 bushels per acre, and the average for the survey area is about 25 bushels per acre. Most of the soils in the survey area are fairly well suited to nonirrigated wheat. At least 80 percent of the soils are loamy and have moderate to high available water capacity.

The "black fallow" system of tillage became popular as a method of conserving moisture after the drought of the 1930's. With this system, a moldboard plow is used in the first major tillage operation. Three or four tillage operations following plowing usually are required to control the weeds and prepare the soil for planting. Use of a black fallow system often is criticized because it exposes the land to wind and water erosion. Soil losses of several tons per acre per year are common. Farmers using this method have been somewhat successful in controlling erosion where (1) wind strips of proper width are used, (2) a cloddy surface is maintained during the fallow season, and (3) wheat is planted early enough and with a drill that leaves a ridged surface.

Use of a system of stubble mulch tillage combined with chemical treatment is being encouraged to replace the black fallow system. With this system, it is possible to keep soil losses at an acceptable level of 5 tons or less per acre per year. If the stubble mulch tillage-fallow system is used, (1) the fallow land should be kept free of weeds from harvesting to planting time (about 14

months), (2) the wheat stubble should be maintained upright during winter to catch snow and reduce water runoff, (3) the soil should be left rough and cloddy during the fallow season and after seeding, (4) as much straw mulch as possible should be retained after seeding, and (5) minimum tillage should be used.

Because weeds can use up a considerable amount of moisture between the harvest and the freezing of the soil in fall, consideration should be given to weed control after harvest. When stubble fields are tilled after harvest, the surface dries out to the depth tilled. For this reason, use of chemicals instead of tillage can conserve moisture, and at about the same cost as mechanical fallow. A suitable way to accomplish this is by spraying, using a contact herbicide plus a residual herbicide shortly after harvest.

Two basic kinds of machines used for tillage are (1) those that stir and mix the soil, such as one-way disks, offset disks, tandem disks, chisel plows, and mulch treaders, and (2) those that cut beneath the surface without rolling the soil, such as sweep undercutters and rod weeders. In selecting the most suitable tillage equipment, soil moisture storage and residue maintenance should be the major factors considered. The number of weeds present, soil texture, and time of tillage also need to be considered. Weeds must be controlled to conserve moisture, but allowing a few weeds to grow may cause less loss of moisture than tilling.

The success of a stubble mulch tillage and chemical fallow program begins with the harvest and the proper distribution of straw. Concentration of straw behind the combine not only makes stubble mulch farming difficult but also reduces the effectiveness of chemicals. Wide scattering of straw and chaff behind the combine is very important.

The use of chemicals in place of mechanical tillage for weed control is still being researched, but several chemicals are available that, if used correctly, aid in the fallow operation. Some tillage is needed for better infiltration of water and for seedbed preparation.

Irrigated cropland.—The irrigated crops in this area include potatoes, pinto beans, great northern beans, corn, small grain, alfalfa hay, and grass hay.

The soils first used for irrigated crops in the survey area were on relict alluvial fans and rolling, low-lying terraces. Irrigated farming began in the late thirties and early forties, when irrigation wells first were being developed. The land on which this development took place generally was nearly level and thus suited to surface irrigation. As time passed and technology improved, hand-moved sprinkler systems began to appear. This meant that more land could be irrigated. The total amount of water pumped from wells in 1964 was estimated to be 28,000 acre-feet, 17,000 of which was used for irrigation in the Pine Bluffs and Carpenter areas. Since that time the acreage of irrigated land in the survey area has increased mainly because of the development of center-pivot sprinklers. Approximately 245 fields totaling 42,000 acres are now irrigated by center-pivot sprinklers. This represents about 6 percent of the total acreage in the survey area.

Most of the irrigated soils in the area are well suited to irrigation. Many of the irrigated fields are nearly level to rolling. Most of the rolling fields are used for close-growing crops such as small grain, grass, and alfalfa. There is a problem of a slow water intake rate on some of the medium textured and fine textured soils, but most of the sprinklers used can be adjusted so that the water application rate fits the particular soil being irrigated. Yields of irrigated crops vary substantially because of differences in management, the fertilizer application rate, the amount of water available throughout the season, and natural hazards such as hail, extreme high winds, and early and late frosts.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification (*6*) shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

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

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

Class I soils have slight limitations that restrict their use. No class I soils are in the survey area because of the semiarid climate.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. Only those soils that have a dependable supply of irrigation water have been placed in class II.

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

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

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

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

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

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

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

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

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Robert Baumgartner, range conservationist, helped to write this section.

Rangeland is land on which the potential plant community is predominantly native grasses, grasslike plants, forbs, and shrubs suitable for grazing or browsing. In addition to providing food for livestock and wildlife, it also provides cover for animals, provides recreation, and has esthetic value.

About 55 percent of the survey area is rangeland. Less than 30 percent of the farm income is derived from livestock, principally cattle. Cow-calf operations are dominant in the northern part of the survey area, and cow-calf-yearling operations are dominant in the southern part. The average size of ranches is about 8,000 acres.

On many ranches the forage produced on rangeland is augmented by crop stubble and small grain. In winter the native forage is often supplemented by hay and protein concentrate. Creep feeding of calves and yearlings to increase their market weight is practiced on some ranches.

In the northern part of the survey area, most of the soils are fine sandy loam and loamy fine sand and are underlain by calcareous sandstone. These soils support tall grasses and mid grasses. In the central part, most of the soils are very fine sandy loam and very gravelly sandy loam, some of which are underlain by gravel and sand. These soils support mid grasses and short grasses. In the southern part, most of the soils are shallow to deep loam, sandy loam, and very gravelly sandy loam. The shallow soils are underlain by soft sandstone, and the deep soils are underlain by gravel, sand, and weakly calcareous material. These soils support mid grasses and short grasses.

In this survey, each map unit in the section "Detailed soil map units" lists the major grasses, grasslike plants, forbs, and shrubs that make up the potential natural plant community. The name of the range site is also given for each map unit.

A range site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was

established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production of each range site 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 includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years.

In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

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

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

The basic soil and plant resources can best be maintained or improved through management. Among the important range management practices on all rangeland in the survey area are proper grazing use and planned grazing systems, which include deferred grazing and proper season of use in combination with good distribution of grazing. Distribution of grazing can be accomplished with proper placement of watering facilities combined with fencing where needed. The suitability of range improvement practices such as brush management, range seeding, and renovation depends on the characteristics of the soils on a given site.

windbreaks

Richard C. Rintamaki, biologist, Soil Conservation Service, wrote this section.

Most of the survey area is treeless. Trees grow naturally mainly on the flood plains along streams. Windbreaks have been planted in the survey area since the early days of settlement. Most of the early plantings were for farmstead and livestock protection, and many farmsteads and ranch headquarters still need this kind of planting. In recent years field windbreaks have been planted to help control wind erosion and conserve moisture, but thousands of acres in the survey area still need some form of protection from the wind.

Windbreaks help to distribute and hold snow, thus preventing the snow from drifting against farmsteads. They also help to protect the houses and livestock from winter winds, reducing fuel and feed costs; protect field crops, gardens, and orchards from damaging winds; reduce evaporation of moisture; help to control wind erosion; and provide habitat for birds and other wildlife.

When planting a windbreak, consider the purpose of the planting, the suitability of the soils, the adaptability of trees and shrubs to the site, and the most advantageous location of the windbreak. Grasses and weeds should be controlled before trees are planted, and regrowth of the ground cover should be controlled during the life of the windbreak. Some replanting generally is needed after the first or second year. Use of drip irrigation insures a higher rate of survival and promotes vigorous growth.

Windbreaks provide protection for a distance of about 10 times the height of the trees. Low-growing shrubs should be planted in the rows on the windward side, medium or tall shrubs in the next rows, and tall trees in the center or on the leeward side. For maximum protection in winter each windbreak should have one or two rows of evergreens, such as Rocky Mountain juniper or ponderosa pine. If the moisture supply is adequate, as in irrigated areas, Colorado blue spruce can be used advantageously. Evergreens live longer and provide more protection than broadleaf trees, but they are more difficult to establish and they grow more slowly.

Among the trees that are grown successfully in windbreaks in the survey area are Siberian elm, green ash, ponderosa pine, eastern redcedar, Russian-olive, hackberry, Scotch pine, eastern cottonwood, Austrian pine, honeylocust, Black Hills spruce, Siberian crabapple, and Colorado blue spruce. Among the shrubs are lilac, Rocky Mountain juniper, Siberian peashrub, skunkbush sumac, chokecherry, American plum, and golden willow.

Information applicable to a particular map unit is given in the section "Detailed soil map units." Additional information on the planting and management of windbreaks can be obtained from the local offices of the Soil Conservation Service and the Cooperative Extension Service.

wildlife habitat

Richard C. Rintamaki, biologist, Soil Conservation Service, helped to write this section.

The survey area provides good habitat for several kinds of wildlife. The areas of range intermingled with irrigated and nonirrigated cropland provide food and cover for many animals and birds. Antelope are the most abundant big game animals, but there are also a few mule deer, mainly around steeply sloping breaks. Beaver and muskrat live along the main streams. The area provides habitat for cottontail rabbit, jackrabbit, coyote, eagles, and hawks, and the range also provides food and cover for grouse.

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

In table 6, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

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

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

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are bluejoint reedgrass, prairie cordgrass, Baltic rush, Nebraska sedge, arrowgrass, and horsetail.

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

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

Habitat for openland wildlife consists of cropland, pasture, and areas that are overgrown with grasses, forbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include ducks, mourning dove, pheasant, meadowlark, cottontail, and red fox.

Habitat for wetland wildlife consists of riparian areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, and muskrat.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, mule deer, ground squirrel, mice, meadowlark, and hawks.

engineering

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

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

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

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

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

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

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

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

building site development

Table 7 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a

flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 8 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

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

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

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

Table 8 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site.

Landfills must be able to bear heavy vehicular traffic. They involve a risk of ground water pollution. Ease of excavation, risk of ground water pollution, and ease of revegetation need to be considered.

The ratings in table 8 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

construction materials

Table 9 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard

construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 9, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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

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

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

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

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

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

water management

Table 10 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

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

soil properties

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

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

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

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

engineering index properties

Table 11 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

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

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

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

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

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

physical and chemical properties

Table 12 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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

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

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

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

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

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

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

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

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 12, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 13 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 13 gives the frequency and duration of flooding and the time of year when flooding is most likely.

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

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

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than

that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 13 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 13.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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

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

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

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 14, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning horizon of clay accumulation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

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

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

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

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*7*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Aberone series

The Aberone series consists of deep, well drained, sloping to rolling soils on terraces. These soils formed in calcareous alluvium. Slopes are 10 to 15 percent.

These soils are loamy-skeletal, carbonatic, mesic Aridic Haplustolls.

Typical pedon of an Aberone fine sandy loam, in an area of Treon-Aberone-Treon, thin solum, fine sandy loams, 6 to 15 percent slopes, 1/2 mile south and 15 feet east of the northwest corner of sec. 5, T. 12 N., R. 63 W.

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

B2—5 to 18 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; mildly alkaline; abrupt wavy boundary.

IICca—18 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, nonsticky and nonplastic; 40 percent calcareous sandstone gravel and 19 percent rounded calcareous sandstone cobbles; 55 percent calcium carbonate; thick coatings of secondary carbonates on gravel and cobbles; strongly effervescent; moderately alkaline.

The solum ranges from 15 to 20 inches in thickness. The calcium carbonate equivalent in the control section ranges from 4 to 55 percent. Depth to calcareous gravel and cobbles ranges from 15 to 20 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has value of 4 or 5 when dry. Reaction is mildly alkaline or moderately alkaline.

The B horizon has value of 4 or 5 when dry. Texture is sandy loam or fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

The C horizon has value of 6 or 7 when dry and 4 or 5 when moist, and it has chroma of 4 or 5. It is 40 to 50 percent calcareous sandstone gravel and 15 to 30 percent calcareous sandstone cobbles.

Albinas series

The Albinas series consists of deep, well drained soils on alluvial terraces. These soils formed in medium textured alluvium derived from mixed sources. Slopes range from 0 to 3 percent.

These soils are fine-loamy, mixed, mesic Pachic Argiustolls.

Typical pedon of Albinas loam, 1 to 3 percent slopes, in the SW1/4SW1/4 of sec. 27, T. 17 N., R. 63 W.

A1—0 to 4 inches; dark brown (10YR 4/3) loam, very dark brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots and pores; mildly alkaline; clear smooth boundary.

B21t—4 to 18 inches; dark brown (10YR 4/3) sandy clay loam, very dark brown (10YR 3/2) moist; moderate coarse prismatic structure; hard, firm, slightly sticky and slightly plastic; many very fine roots and pores; thin continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—18 to 24 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; hard, firm, slightly sticky and slightly plastic; many very fine roots and pores; common thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B23tca—24 to 32 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; hard, firm, slightly sticky and slightly plastic; few very fine roots and pores; common thin clay films on faces of peds and in pores; slightly effervescent; mildly alkaline; abrupt wavy boundary.

Cca—32 to 60 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; filaments and threads of carbonates throughout; strongly effervescent; mildly alkaline.

The solum is 26 to 40 inches thick. The mollic epipedon is 23 to 30 inches thick. It includes all or most of the argillic horizon.

The A horizon has hue of 10YR to 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B2t horizon has hue of 7.5YR to 10YR, and it has value of 3 to 5 when dry and 2 or 3 when moist. It has chroma of 2 or 3 in upper part and 2 to 4 in the lower part. Texture is loam, clay loam, or sandy clay loam. Reaction is neutral or mildly alkaline.

The Cca horizon has hue of 10YR to 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 3 to 5. Texture is loam, silt loam, or fine sandy loam. The calcium carbonate equivalent ranges from 10 to 15 percent. Reaction is mildly alkaline or moderately alkaline.

Alice series

The Alice series consists of deep, well drained, nearly level to undulating soils on alluvial terraces. These soils formed in moderately coarse textured alluvium. Slopes are 0 to 6 percent.

These soils are coarse-loamy, mixed, mesic Aridic Haplustolls.

Typical pedon of Alice fine sandy loam, 0 to 3 percent slopes, at the northwest corner of sec. 7, T. 14 N., R. 60 W.

A1—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam, dark grayish brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots and pores; mildly alkaline; clear smooth boundary.

B1—4 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to coarse subangular blocky; hard, friable, nonsticky and nonplastic; many very fine roots and pores; mildly alkaline; abrupt smooth boundary.

B2—18 to 25 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots and pores; mildly alkaline; abrupt smooth boundary.

C1ca—25 to 30 inches; pale brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; soft masses of lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2ca—30 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; soft masses of lime; violently effervescent; moderately alkaline.

Thickness of the solum and depth to secondary carbonates range from 21 to 35 inches. The mollic epipedon is 7 to 20 inches thick.

The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3.

The B2 horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 2 or 3. Texture is very fine sandy loam or fine sandy loam. The horizon is mildly alkaline or moderately alkaline.

The Cca horizon has value of 6 or 7 when dry and 5 or 6 when moist, and it has chroma of 2 to 4. Texture is fine sandy loam, loam, or silt loam. The horizon is mildly alkaline or moderately alkaline. The calcium carbonate equivalent ranges from 5 to 15 percent.

Altvan series

The Altvan series consists of deep, well drained soils on alluvial terraces. These soils formed mainly in mixed alluvium. Slopes are 0 to 15 percent.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls.

Typical pedon of Altvan loam, 0 to 3 percent slopes, at the southeast corner of sec. 29, T. 13 N., R. 64 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

B21t—9 to 13 inches; dark brown (10YR 4/3) sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse subangular blocky structure; hard, firm, nonsticky and slightly nonplastic; many very fine roots and pores; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—13 to 25 inches; dark brown (10YR 4/3) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; many very fine roots and pores; common moderately thick clay films on faces of peds and lining pores; moderately alkaline; clear smooth boundary.

B3tca—25 to 28 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few thin clay films on faces of peds; soft masses of lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIC1—28 to 40 inches; brown (10YR 5/3) very gravelly sand, brown (10YR 5/3) moist; single grain; loose; 40 percent gravel; slightly effervescent; moderately alkaline; abrupt wavy boundary.

IIC2—40 to 60 inches; brown (10YR 5/3) very gravelly sand, dark brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; 45 percent gravel; slightly effervescent; moderately alkaline.

The solum ranges from 16 to 32 inches in thickness. Depth to carbonates ranges from 16 to 32 inches. Depth to calcareous very gravelly sand ranges from 20 to 32 inches. Content of small angular pebbles on the surface and throughout the solum ranges from 0 to 10 percent. The mollic epipedon is 7 to 9 inches thick.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3.

The B2t horizon has value of 4 or 5 when dry and 3 or 4 when moist. Texture is dominantly sandy clay loam, but it ranges to clay loam that is less than 35 percent clay. Reaction is mildly alkaline or moderately alkaline.

The IIC horizon commonly is calcareous and has lime coatings on the angular pebbles.

Ascalon series

The Ascalon series consists of deep, well drained, nearly level to undulating soils on plains. These soils formed in old alluvium derived from mixed sources. Slopes are 0 to 6 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Ascalon loam, 1 to 3 percent slopes, at the southwest corner of sec. 10, T. 13 N., R. 64 W.

A1—0 to 5 inches; dark brown (10YR 4/3) loam, very dark brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

B21t—5 to 12 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; hard, firm, slightly sticky and slightly plastic; many very fine roots; moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—12 to 21 inches; brown (10YR 5/3) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; hard, firm, slightly sticky and slightly plastic; many very fine roots; moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B23tca—21 to 38 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; few thin clay films on faces of peds; visible accumulation of calcium carbonate as concretions and in seams; strongly effervescent; mildly alkaline; clear smooth boundary.

Cca—38 to 60 inches; light yellowish brown (10YR 6/4) loam, light yellowish brown (10YR 6/4) moist; massive; soft, friable, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

The solum ranges from 32 to 40 inches in thickness. Depth to calcareous material ranges from 20 to 30 inches. Thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B2t horizon has hue of 7.5YR to 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4. Texture typically is sandy clay loam but ranges to clay loam in the upper part. Reaction is neutral or mildly alkaline.

The Cca horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 4 or 5. Texture is loam, very fine sandy loam, or sandy clay loam.

Bayard series

The Bayard series consists of deep, well drained, nearly level to rolling soils on alluvial fans and terraces. These soils formed in moderately coarse textured, mixed alluvium. Slopes are 0 to 10 percent.

These soils are coarse-loamy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of Bayard fine sandy loam, 0 to 3 percent slopes, in the SW1/4 of sec. 5, T. 14 N., R. 61 W.

A11—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

A12—8 to 16 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C1—16 to 60 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; strongly effervescent; moderately alkaline.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3 when dry or moist. It is neutral or mildly alkaline.

The C horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 2 or 3.

Bayard Variant

The Bayard Variant consists of deep, somewhat poorly drained soils on flood plains. These soils formed in alluvium derived from mixed sources. Slopes are 0 to 3 percent.

These soils are coarse-loamy, mixed, mesic Torrifluventic Haplustolls.

Typical pedon of Bayard Variant fine sandy loam, 0 to 3 percent slopes, in the NW1/4SE1/4 of sec. 2, T. 18 N., R. 63 W.

A1—0 to 10 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; strongly effervescent; mildly alkaline; clear smooth boundary.

C1—10 to 30 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots; strongly effervescent; mildly alkaline; clear smooth boundary.

C2—30 to 60 inches; light gray (10YR 7/2) sandy loam, very pale brown (10YR 7/3) moist; massive; soft, friable, nonsticky and nonplastic; strongly effervescent; mildly alkaline.

The mollic epipedon is 10 to 15 inches thick. Depth to calcareous material is 0 to 5 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The C horizon has value of 5 to 7 and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

Dix series

The Dix series consists of deep, excessively drained, sloping to steep and undulating soils on alluvial terraces. These soils formed in gravelly, sandy alluvium. Slopes are 6 to 30 percent.

These soils are sandy-skeletal, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of a Dix very gravelly sandy loam, in an area of Dix-Altvan complex, 10 to 30 percent slopes, in the NE1/4NE1/4 of sec. 7, T. 18 N., R. 62 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine pores; 35 percent gravel; mildly alkaline; clear smooth boundary.

IIC1—10 to 28 inches; yellowish brown (10YR 5/6) very gravelly coarse sand, yellowish brown (10YR 5/6) moist; single grain; loose; 40 percent gravel; mildly alkaline; abrupt wavy boundary.

IIIC2—28 to 60 inches; yellowish brown (10YR 5/6) very gravelly coarse sand, yellowish brown (10YR 5/6) moist; single grain; loose; 55 percent gravel; slightly effervescent; mildly alkaline.

The mollic epipedon ranges from 8 to 13 inches in thickness. Depth to gravelly coarse sand ranges from 10 to 13 inches. The gravel in the lower part of the C horizon in some pedons is coated with calcium carbonate.

The A1 horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3.

The C horizon has value of 5 or 6. Texture typically is very gravelly coarse sand, but it ranges to very gravelly loamy sand. The gravel content ranges from 35 to 60 percent.

Jayem series

The Jayem series consists of deep, well drained, nearly level to undulating soils on uplands. These soils formed in sediment derived dominantly from noncalcareous sandstone. Slopes are 0 to 6 percent.

These soils are coarse-loamy, mixed, mesic Aridic Haplustolls.

Typical pedon of Jayem fine sandy loam, 0 to 3 percent slopes, in the SW1/4SW1/4 of sec. 18, T. 17 N., R. 62 W.

A1—0 to 15 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; strong fine granular structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

B1—15 to 22 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

B2—22 to 40 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; mildly alkaline; clear smooth boundary.

C1—40 to 60 inches; yellowish brown (10YR 5/6) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; mildly alkaline.

The mollic epipedon ranges from 8 to 20 inches in thickness.

The A1 horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B horizon has hue of 7.5YR to 10YR, value of 5 or 6, and chroma of 3 or 4. Reaction is neutral or mildly alkaline.

The C horizon has hue of 7.5YR to 10YR, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 4 to 6. Texture is fine sandy loam or sandy loam. Reaction is neutral or mildly alkaline.

Manter series

The Manter series consists of deep, well drained, nearly level to rolling soils on old dissected alluvial fans and terraces. These soils formed in moderately coarse textured, calcareous eolian and outwash material derived from mixed sources. Slopes are 0 to 10 percent.

These soils are coarse-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Manter sandy loam, 0 to 3 percent slopes, in the NW1/4SE1/4 of sec. 17, T. 18 N., R. 63 W.

A1—0 to 7 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

B1t—7 to 12 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B2t—12 to 25 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; moderate coarse prismatic structure; hard, firm, nonsticky and nonplastic; many very fine roots; common thick clay films on faces of peds; mildly alkaline; clear wavy boundary.

C1ca—25 to 37 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; lime disseminated throughout; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—37 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; soft masses of lime; strongly effervescent; moderately alkaline.

Thickness of the solum and depth to secondary carbonates range from 23 to 40 inches. The calcium carbonate equivalent in the profile ranges from 5 to 12 percent. The mollic epipedon ranges from 8 to 15 inches in thickness.

The A1 horizon has hue of 7.5YR to 10YR, value of 4 or 5 when dry, and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B2t horizon has hue of 7.5YR to 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4. Reaction is neutral or mildly alkaline.

The Cca horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 3 or 4. Texture is sandy loam or fine sandy loam.

Manter Variant

The Manter Variant consists of shallow, well drained, nearly level to undulating soils on uplands. These soils formed in moderately coarse textured material derived dominantly from noncalcareous sandstone. Slopes are 0 to 6 percent.

These soils are loamy, mixed, mesic, shallow Aridic Argiustolls.

Typical pedon of Manter Variant fine sandy loam, 0 to 3 percent slopes, in the SE1/4SE1/4 of sec. 29, T. 18 N., R. 63 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

B2t—4 to 11 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; few thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

Cr—11 inches; soft noncalcareous sandstone.

The mollic epipedon ranges from 7 to 15 inches in thickness. Depth to sandstone ranges from 10 to 20 inches.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The A horizon is neutral or mildly alkaline.

The B2t horizon has hue of 7.5YR or 10YR and has value of 4 or 5 when dry and 3 or 4 when moist. It is less than 18 percent clay.

Merden series

The Merden series consists of deep, poorly drained soils on flood plains and in drainageways. These soils formed in medium textured alluvium. Slopes are 0 to 3 percent.

These soils are fine-loamy, mixed (calcareous), mesic Fluvaquentic Haplaquolls.

Typical pedon of Merden loam, 0 to 3 percent slopes, at the northeast corner of sec. 9, T. 14 N., R. 60 W.

A11—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; strongly alkaline; clear smooth boundary.

A12—10 to 20 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; very weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; strongly alkaline; clear smooth boundary.

C1g—20 to 60 inches; gray (5Y 5/1) loam, dark gray (5Y 4/1) moist; massive; hard, firm; strongly effervescent; moderately alkaline.

The mollic epipedon ranges from 10 to 20 inches in thickness. The profile is strongly alkaline or very strongly alkaline.

The A11 horizon has value of 4 or 5 when dry and 2 or 3 when moist. The A12 horizon has value of 4 or 5 when dry.

The C1g horizon has hue of 5Y to 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 1 or 2.

Merden Variant

The Merden Variant consists of deep, poorly drained soils on flood plains and along drainageways. These soils formed in moderately fine textured alluvium derived dominantly from siltstone. Slopes are 0 to 3 percent.

These soils are fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls.

Typical pedon of Merden Variant silty clay loam, 0 to 3 percent slopes, in the NE1/4NE1/4 of sec. 7, T. 12 N., R. 60 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; hard, firm, sticky and plastic; many very fine roots; slightly effervescent; strongly alkaline; clear smooth boundary.

C1—10 to 25 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak fine granular structure; hard, firm, sticky and plastic; many very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C2g—25 to 47 inches; white (5Y 8/2) silty clay loam, light olive gray (5Y 6/2) moist; few fine faint mottles that are light gray (10YR 7/2) when moist; massive; hard, firm, sticky and plastic; many very fine roots; strongly effervescent; strongly alkaline; clear smooth boundary.

C3g—47 to 60 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; few fine faint brown (7.5YR 5/4) mottles; massive; hard, firm, sticky and plastic; strongly effervescent; moderately alkaline.

The mollic epipedon ranges from 10 to 18 inches in thickness. The control section averages less than 35 percent clay.

The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist.

The C1 horizon has hue of 7.5YR or 10YR, and it has value of 6 or 7 when dry and 4 or 5 when moist. It is silty clay, silty clay loam, or clay loam and is less than 15 percent sand that is fine or coarser. The Cg horizon has hue of 10YR to 5Y, value of 7 or 8 when dry and 5 or 6 when moist, and chroma of 1 or 2. It is silty clay or silty clay loam and is moderately alkaline or strongly alkaline.

Mitchell series

The Mitchell series consists of deep, well drained, nearly level to rolling soils on alluvial fans and terraces. These soils formed in calcareous alluvium. Slopes are 0 to 10 percent.

These soils are coarse-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Mitchell very fine sandy loam, 0 to 3 percent slopes, 100 feet west of Wyoming Highway 215, 2,640 feet north of the southeast corner of sec. 19, T. 13 N., R. 60 W.

A1—0 to 3 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; moderately alkaline; abrupt wavy boundary.

AC—3 to 14 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1—14 to 33 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2—33 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; lime disseminated throughout; strongly effervescent; moderately alkaline.

Continuously calcareous material is at a depth of 0 to 4 inches. The A1 horizon has value of 5 or 6 when dry. The AC and C horizons have value of 5 to 7 when dry and 4 to 6 when moist, and they have chroma of 3 or 4. Texture is dominantly silt loam, but it includes loam and very fine sandy loam that are less than 15 percent fine to coarse sand.

Mitchell Variant

The Mitchell Variant consists of moderately deep, moderately well drained soils on uplands that have been leveled for irrigated hay and pasture. These soils formed in silty calcareous alluvium. Slopes are 0 to 3 percent.

These soils are coarse-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Mitchell Variant fine sandy loam, in an area of Mitchell Variant-Tassel Variant fine sandy loams, 0 to 3 percent slopes, 1/2 mile north and 500 feet west of the southeast corner of sec. 19, T. 18 N., R. 61 W.

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; slightly effervescent; strongly alkaline; clear smooth boundary.

AC—3 to 17 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; very weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; lime disseminated throughout; strongly effervescent; strongly alkaline; clear smooth boundary.

C1—17 to 25 inches; yellowish brown (10YR 5/4) silt loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; lime disseminated throughout; strongly effervescent; strongly alkaline; abrupt wavy boundary.

C2—25 to 32 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; lime disseminated throughout; strongly effervescent; strongly alkaline; abrupt wavy boundary.
Cr—32 inches; soft calcareous siltstone.

The depth to soft calcareous siltstone ranges from 20 to 40 inches.

The A1 horizon has value of 4 or 5 when dry and 3 or 4 when moist, and it has chroma of 2 or 3. Reaction is strongly alkaline or very strongly alkaline. The AC horizon has value of 5 to 7 when dry and 3 to 5 when moist, and it has chroma of 3 or 4. It is dominantly sandy loam, but the range includes fine sandy loam and very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline.

The C horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 3 or 4. Reaction is strongly alkaline or very strongly alkaline.

Nucla series

The Nucla series consists of deep, well drained, nearly level to undulating soils on alluvial fans. These soils formed in loamy calcareous alluvium derived from mixed sources. Slopes are 0 to 6 percent.

These soils are fine-loamy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of Nucla fine sandy loam, 0 to 3 percent slopes, at the southeast corner of sec. 19, T. 13 N., R. 60 W.

A1—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
B21—2 to 9 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure; hard, firm, sticky and plastic; many very fine roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.
B22—9 to 14 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure; hard, firm, sticky and plastic; many very fine roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.
C1ca—14 to 32 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few soft masses of carbonates; strongly effervescent; moderately alkaline; abrupt wavy boundary.
C2ca—32 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; few soft masses of carbonates; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to secondary carbonates range from 12 to 21 inches. The mollic epipedon is 8 to 20 inches thick.

The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. Reaction is mildly alkaline or moderately alkaline.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6 when dry and 3 to 5 when moist, and chroma of 2 to 4. Texture is loam, silt loam, or very fine sandy loam. The horizon is 20 to 50 percent silt and more than 15 percent fine sand. Reaction is mildly alkaline or moderately alkaline.

The Cca horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 4 or 5. Texture is silt loam, fine sandy loam, or loam.

Otero series

The Otero series consists of deep, well drained soils on nearly level to hilly fans and alluvial terraces. These soils formed in calcareous alluvium derived from mixed sources. Slopes are 0 to 30 percent.

These soils are coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Otero fine sandy loam, 0 to 3 percent slopes, at the center of sec. 15, T. 18 N., R. 61 W.

A1—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine platy structure; soft, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
C1—2 to 37 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; strongly effervescent; moderately alkaline; abrupt wavy boundary.
C2—37 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 5/4) moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; few fine soft masses of lime; strongly effervescent; moderately alkaline.

Depth to visible calcium carbonate ranges from 0 to 2 inches. The calcium carbonate equivalent ranges from 2 to 4 percent.

The A1 horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 3 or 4. Reaction is mildly alkaline or moderately alkaline.

The C horizon has hue of 7.5YR to 10YR, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 3 or 4.

Paoli series

The Paoli series consists of deep, well drained soils on terraces. These soils formed in thick calcareous alluvium. Slopes are 0 to 3 percent.

These soils are coarse-loamy, mixed, mesic Pachic Haplustolls.

Typical pedon of Paoli fine sandy loam, 0 to 3 percent slopes, in the SE1/4SE1/4 of sec. 13, T. 12 N., R. 64 W.

A11—0 to 7 inches; dark brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

A12—7 to 38 inches; dark brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Cca—38 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable, nonsticky and nonplastic; filaments of secondary calcium carbonate; strongly effervescent; moderately alkaline.

Depth to uniformly calcareous material ranges from 0 to 10 inches. Depth to secondary calcium carbonate ranges from 20 to 40 inches. The mollic epipedon ranges from 20 to 40 inches in thickness.

The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. Reaction is mildly alkaline or moderately alkaline.

The Cca horizon has hue of 7.5YR to 10YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 or 3. Texture is fine sandy loam or sandy loam.

Tassel series

The Tassel series consists of shallow and very shallow, well drained soils on uplands, commonly on the crest of ridges. These soils formed in calcareous material derived dominantly from sandstone. Slopes are 10 to 30 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Tassel fine sandy loam, in an area of Tassel, thin solum-Tassel-Rock outcrop complex, 10 to 30 percent slopes, in the NE1/4SW1/4 of sec. 1, T. 18 N., R. 63 W.

A1—0 to 6 inches; brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many very fine roots; 10 percent channery fragments of soft sandstone; strongly effervescent; mildly alkaline; clear smooth boundary.

C1—6 to 12 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Cr—12 inches; soft, strongly calcareous sandstone.

Depth to soft, calcareous sandstone ranges from 6 to 20 inches.

The A and C1 horizons have value of 5 to 7 when dry and 4 or 5 when moist, and they have chroma of 2 or 3. Reaction is mildly alkaline or moderately alkaline.

Tassel Variant

The Tassel Variant consists of shallow, well drained soils on uplands that have been leveled. These soils formed in silty calcareous alluvium. Slopes are 0 to 3 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Tassel Variant fine sandy loam, in an area of Mitchell Variant-Tassel Variant fine sandy loams, 0 to 3 percent slopes, 1,060 feet north and 800 feet east of the southwest corner of sec. 20, T. 18 N., R. 61 W.

A1—0 to 5 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; slightly effervescent; very strongly alkaline; clear smooth boundary.

C1—5 to 15 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; strongly effervescent; very strongly alkaline; clear smooth boundary.

Cr—15 inches; calcareous fine-grained siltstone.

The solum ranges from 3 to 8 inches in thickness. Depth to bedrock ranges from 10 to 20 inches.

The A horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 3 or 4. Reaction is strongly alkaline or very strongly alkaline.

The C horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 3 or 4. It is dominantly silt loam, but the range includes silty clay loam and loam. Reaction is strongly alkaline or very strongly alkaline.

Treon series

The Treon series consists of shallow and very shallow, well drained, sloping to steep soils on hills and uplands. These soils formed in calcareous material derived from Ogallala Sandstone. Slopes are 6 to 30 percent.

These soils are loamy, mixed, mesic, shallow Torriorthentic Haplustolls.

Typical pedon of a Treon fine sandy loam, in an area of Treon-Aberone-Treon, thin solum, fine sandy loams, 6 to 15 percent slopes, in the NE1/4NE1/4 of sec. 6, T. 12 N., R. 63 W.

A11—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; single grain; soft, very friable; many fine roots; slightly effervescent; mildly alkaline; clear smooth boundary.

A12—4 to 10 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; 5 percent angular gravel; coatings of secondary lime on gravel; strongly effervescent; mildly alkaline; clear smooth boundary.

Cca—10 to 14 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, friable, slightly sticky and nonplastic; few fine roots; 10 percent angular gravel; strongly effervescent; mildly alkaline; clear smooth boundary.

Cr—14 inches; soft calcareous sandstone that has some fractures.

The mollic epipedon is 6 to 16 inches thick. Depth to soft sandstone ranges from 6 to 20 inches. Gravel content ranges from 0 to 15 percent.

The A11 horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The A12 horizon has value of 3 to 5 when dry and 2 or 3 when moist.

The Cca horizon is not present in some pedons.

Valent series

The Valent series consists of deep, excessively drained, nearly level to rolling soils on plains. These soils formed in eolian sand. Slopes are 0 to 15 percent.

These soils are mixed, mesic Ustic Torripsamments.

Typical pedon of Valent loamy fine sand, 0 to 6 percent slopes, at the southwest corner of sec. 7, T. 18 N., R. 60 W.

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; many very fine roots; mildly alkaline; abrupt wavy boundary.

C1—8 to 37 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; single grain; loose; many very fine roots; mildly alkaline; abrupt wavy boundary.

C2—37 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; few very fine roots; mildly alkaline.

Depth to calcareous material is more than 40 inches.

The A1 horizon has value of 5 or 6 when dry and 4 or 5 when moist. Reaction is neutral or mildly alkaline.

The C horizon has hue of 7.5YR to 10YR, and it has value of 5 to 7 when dry and 4 or 5 when moist. Reaction is neutral or mildly alkaline.

Vetal series

The Vetal series consists of deep, well drained, nearly level to undulating soils on alluvial fans and terraces. These soils formed in alluvium. Slopes are 0 to 6 percent.

These soils are coarse-loamy, mixed, mesic Pachic Haplustolls.

Typical pedon of Vetal fine sandy loam, 1 to 3 percent slopes, in the NE1/4NE1/4 of sec. 30, T. 14 N., R. 62 W.

A11—0 to 10 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

A12—10 to 27 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

C1—27 to 60 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; mildly alkaline.

The mollic epipedon ranges from 20 to 30 inches in thickness. The profile is noncalcareous to a depth of 40 inches or more.

The A1 horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3. Texture is fine sandy loam or loamy fine sand.

The C horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 2 or 3. Texture is fine sandy loam or sandy loam.

Wages series

The Wages series consists of deep, well drained soils on alluvial fans and terraces. These soils formed in mixed alluvium. Slopes are 0 to 3 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Wages loam, 0 to 3 percent slopes, near the southwest corner of sec. 34, T. 17 N., R. 63 W.

A1—0 to 4 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; mildly alkaline; clear smooth boundary.

B21t—4 to 7 inches; dark brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/3) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; many very fine roots; common thin patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—7 to 13 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; many very fine roots; patches of clay films on faces of peds; mildly alkaline; clear smooth boundary.

C1ca—13 to 20 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; 10 percent fine gravel; gravel coated with calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

C2ca—20 to 60 inches; very pale brown (10YR 7/3) gravelly sandy loam, very pale brown (10YR 7/3) moist; massive; hard, firm, sticky and plastic; 15 percent fine gravel; calcium carbonate coating gravel and in the form of soft masses; strongly effervescent; moderately alkaline.

Thickness of the solum and depth to calcareous material range from 10 to 14 inches. Thickness of the mollic epipedon ranges from 7 to 10 inches. The calcium carbonate equivalent ranges from 5 to 10 percent. Depth to calcareous material ranges from 12 to 15 inches.

The A1 horizon has value of 4 or 5, and it has chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B2t horizon has hue of 7.5YR to 10YR, and it has value of 5 or 6 when dry and 3 or 4 when moist. Texture is clay loam or sandy clay loam. Reaction is neutral or mildly alkaline.

The C1ca horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 3 or 4. Texture is loam, silt loam, or fine sandy loam. The C2ca horizon has value of 6 or 7 when dry, and it has chroma of 3 or 4. It typically is less than 20 percent fine gravel. Calcium carbonate content ranges from 10 to 15 percent.

formation of the soils

This section discusses the factors and processes of soil formation and relates them to the formation of the soils in the survey area.

Soil is formed by the action of soil-forming processes on parent material that was deposited or accumulated by geologic forces. Soil characteristics are determined by the interaction of five factors of soil formation. The five interacting factors are (1) the physical and mineralogical composition of the parent material; (2) the climate under which the parent material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or the lay of the land; and (5) the length of time these forces have acted on the parent material. All of these factors are important, but some are more important than others. The five factors are discussed in the following paragraphs.

parent material

Parent material consists of weathered rock or partly weathered material from which the soil has formed. The soils of this survey area formed in three main kinds of parent material: (1) eolian deposits, (2) recent alluvium, and (3) old alluvium.

During the Tertiary Period, repeated uplift and erosion of the Rocky Mountains caused recurrent deposition of material by streams. The White River Formation, which has been partially influenced by volcanic activity, was deposited during the Oligocene Epoch of the Tertiary Period. It is the oldest alluvium in the survey area. The White River Formation consists of pinkish brown siltstone and has red and green clay in the lower part. In some areas it contains coarse textured channel deposits. Soils associated with the White River Formation are those of the Nucla and Mitchell series. These soils are silty and calcareous, and they exhibit minimum profile development.

The Arikaree Formation, the next oldest alluvium, consists mainly of fine-grained sand, suggesting that it was laid down by streams during the relatively quiet times of the Miocene Epoch. The beds of ash in the area show that sporadic volcanism probably took place during this epoch. The Arikaree Formation consists of light gray sandstone that is very fine grained to fine grained and of weakly to strongly cemented beds of silt. Coarse conglomerate is in some areas. Soils associated with the Arikaree Formation are those of the Tassel, Treon, Aberone, Vetal, and Valent series. Tassel and Treon soils are shallow and alluvial. Aberone, Vetal, and Valent soils are deep; they formed in wind-worked material derived from Arikaree Sandstone. These soils exhibit little development.

The Miocene and Pliocene Ogallala Formation, the youngest of the Tertiary formations, consists of lenticular beds of sand and gravel, deposited by braided streams, and of silt and clay. The gravel in the Ogallala Formation was transported from the mountains to the west. Ascalon, Altvan, Wages, Manter, and Albinas soils formed in material derived from the Ogallala Formation. These soils show distinct horizonation. Dix soils are the only ones associated with this formation that do not have a subsoil. These soils commonly are on high, very gravelly terraces.

Recent alluvium occurs in this survey area as flood plain deposits. This material consists of unconsolidated silt, sand, and gravel. The poorly drained and somewhat poorly drained Bayard Variant, Merden, and Merden Variant soils formed in this material. Bayard Variant and Merden soils exhibit little profile development.

Extensive coarse textured eolian deposits are along Horse Creek and at the base of sandstone breaks in the survey area. These deposits commonly consist of calcareous and noncalcareous, pale brown sand and loamy fine sand. They have been reworked, transported, and deposited as low sand dunes by the prevailing northwesterly and southwesterly winds. The soils in areas of this material are nearly level to undulating and rolling. Soils of the Valent and Otero series formed in this material. Only an A horizon has developed in these soils.

climate

Climate, through its influence on the vegetation, the rate of biological activity, and the physical and chemical weathering of parent material, has been important in the development of the soils in the survey area. Soil temperature and moisture have been the main factors in soil development. Such factors as wind velocity and humidity also have had a significant influence.

The survey area has a semiarid climate. Summers usually are warm, and winters are cold. The average annual precipitation is 15 to 17 inches. The average annual air temperature ranges from 45 to 47 degrees. The amount of precipitation received and variations in temperature contribute to accumulation of organic matter

in the soil, the physical movement of substances in suspension or solution, and the rate of chemical processes.

The limited amount of rainfall in the survey area has controlled the depth to which calcium carbonate has been leached in most soils. It has also controlled the thickness of the B horizon, where present. Because of relatively low precipitation, high temperatures, cool nights, and shallow frost-penetration depth, the chemical and biological processes of soil formation proceed slowly. The content of organic matter in the soils of this area is low. As a result, the soils have a thin surface layer and light color. Except in wet years, the soils in areas that are dry-farmed or used for grazing are seldom wet below the depth of live roots. The low humidity in the area causes a high loss of water through evaporation. This loss has influenced soil formation because it reduces the amount of water that percolates through the soil.

plant and animal life

Plants, micro-organisms, earthworms, and other forms of plant and animal life on or in the soil influence the formation of soils. The kinds of plants and micro-organisms in any area are controlled mainly by soil temperature, soil moisture supply, and the physical and chemical characteristics of the soils. The native vegetation in the survey area consists primarily of tall, mid, and short grasses. These grasses are important in soil formation. Roots penetrate the soil material and increase its permeability to air and water. As roots and other organic matter decay, needed nutrients are released for use by plants and other organisms. Plants help to counteract leaching by bringing minerals up from the lower horizons.

The decomposed organic matter in the soil provides food for the micro-organisms and is changed by them into humus. Prairie dogs, gophers, and badgers are some of the common animals that aid in mixing the soil material. Earthworms feed on organic matter and also help to mix the soil material. Wormcasts increase the fertility of the soils.

relief

In many areas relief is the most important factor in determining the kinds of soil that have formed. Relief influences the formation of soils by its effect on drainage, runoff, and erosion. The internal drainage and moisture content of soils differ in areas of different relief. If plant cover and rainfall are about the same in two areas, runoff is more rapid where slopes are steep than it is where they are nearly level. Steeply sloping soils generally have a thinner surface layer and exhibit less development in the subsoil. Nearly level soils exhibit more development. For example, Ascalon soils are more nearly level than Tassel soils and thus exhibit more development. Maintaining a good cover on the steeper slopes reduces the movement of material downslope and increases the movement of water into the profile. Calcium carbonate is closer to the surface in steep soils than in more nearly level soils.

Runoff tends to concentrate in depressional areas. Soils in these areas receive more water than is normally supplied by precipitation and tend to have a thicker, darker colored surface layer and are leached to a greater depth. Albinas and Vetal soils have these characteristics.

time

The formation of soil requires time. The length of time depends to a large extent on the kind of parent material. In stable areas soil horizons develop simultaneously with the weathering of the parent material. In transported, unconsolidated material such as alluvium, soil formation does not begin until the material has become stabilized. A soil profile may form in some fresh material within a few years, but in other material a much longer time may be required. A long time may pass between the time parent material is deposited and soil horizons form.

Soil development can best be evaluated by observing specific soil characteristics than by considering the length of time the soil has been developing. Characteristics commonly used to determine the comparative maturity of soils are the thickness and color of the surface layer, the degree of structure in the subsoil, the extent of clay movement, and the thickness of the solum. Older soils generally have more distinct genetic horizons than younger soils. Examples of older soils in the survey area are those of the Ascalon, Wages, and Manter series, which exhibit clay enrichment and horizons of calcium carbonate accumulation. Examples of younger soils are those of the Mitchell, Valent, and Otero series, which do not have distinct subsoil development.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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 (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet 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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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 and measurements are of thediameter 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 simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field 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.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1941-70 at Pine Bluffs, Wyo.]

Month	Temperature				Precipitation	
	Average daily maximum	Average daily minimum	Average daily	Average number of growing degree days[1]	Average	Average number of days with 0.10 inch or more
	°F	°F	°F	Units	In	
January	40.9	12.8	26.7	0	0.46	6
February	43.8	16.3	30.1	0	0.46	9
March	47.3	19.5	33.4	0	1.05	15
April	59.6	29.9	44.8	144	1.57	18
May	69.6	39.6	54.6	432	2.52	23
June	79.3	48.1	63.7	711	2.41	23
July	88.5	54.4	71.5	976	1.82	15
August	86.8	52.9	69.9	926	1.82	17
September	71.1	42.9	60.0	600	1.03	14
October	65.2	32.8	49.0	279	0.95	11
November	50.2	22.2	36.2	0	0.58	8
December	42.6	25.8	34.2	0	0.35	8
Yearly:						
Average	62.5	33.1	47.8	---	---	---
Extreme	---	---	---	---	---	---
Total	---	---	---	4,068	15.02	167

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and substracting 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 1941-70
at Pine Bluffs, Wyo.]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 13	May 23	June 9
2 years in 10 later than--	May 5	May 15	June 1
5 years in 10 later than--	April 27	May 7	May 24
First freezing temperature in fall:			
1 year in 10 earlier than--	September 25	September 12	September 2
2 years in 10 earlier than--	October 4	September 21	September 11
5 years in 10 earlier than--	October 13	September 30	September 20

TABLE 3.--GROWING SEASON

[Recorded in the period 1941-70
at Pine Bluffs, Wyo.]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	136	115	86
8 years in 10	153	130	103
5 years in 10	170	147	120
2 years in 10	187	164	136
1 year in 10	204	181	154

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Albinas loam, 0 to 1 percent slopes	1,376	0.2
2	Albinas loam, 1 to 3 percent slopes	77,475	11.1
3	Alice fine sandy loam, 0 to 3 percent slopes	3,688	0.5
4	Alice fine sandy loam, 3 to 6 percent slopes	3,668	0.5
5	Altvan loam, 0 to 3 percent slopes	105,089	15.0
6	Altvan loam, 3 to 6 percent slopes	15,705	2.2
7	Altvan-Dix complex, 6 to 10 percent slopes	20,202	2.9
8	Ascalon loam, 0 to 1 percent slopes	896	0.1
9	Ascalon loam, 1 to 3 percent slopes	113,114	16.2
10	Ascalon loam, 3 to 6 percent slopes	14,418	2.1
11	Bayard fine sandy loam, 0 to 3 percent slopes	15,885	2.2
12	Bayard fine sandy loam, 3 to 6 percent slopes	7,650	1.1
13	Bayard fine sandy loam, 6 to 10 percent slopes	2,518	0.4
14	Bayard Variant fine sandy loam, 0 to 3 percent slopes	3,278	0.5
15	Dix-Altvan complex, 10 to 30 percent slopes	11,477	1.6
16	Dix-Otero complex, 6 to 10 percent slopes	1,013	0.1
17	Jayem fine sandy loam, 0 to 3 percent slopes	3,926	0.6
18	Jayem fine sandy loam, 3 to 6 percent slopes	1,597	0.2
19	Manter sandy loam, 0 to 3 percent slopes	12,190	1.7
20	Manter sandy loam, 3 to 6 percent slopes	7,493	1.1
21	Manter sandy loam, 6 to 10 percent slopes	1,339	0.2
22	Manter Variant fine sandy loam, 0 to 3 percent slopes	1,936	0.3
23	Merden loam, 0 to 3 percent slopes	1,538	0.2
24	Merden Variant silty clay loam, 0 to 3 percent slopes	3,855	0.6
25	Mitchell very fine sandy loam, 0 to 3 percent slopes	4,259	0.6
26	Mitchell very fine sandy loam, 3 to 6 percent slopes	3,246	0.5
27	Mitchell very fine sandy loam, 6 to 10 percent slopes	1,077	0.2
28	Mitchell Variant-Tassel Variant fine sandy loams, 0 to 3 percent slopes	350	0.1
29	Nucla fine sandy loam, 0 to 3 percent slopes	11,650	1.7
30	Nucla fine sandy loam, 3 to 6 percent slopes	1,324	0.2
31	Nucla-Mitchell fine sandy loams, 0 to 3 percent slopes	7,117	1.0
32	Nucla-Mitchell fine sandy loams, 3 to 6 percent slopes	2,630	0.4
33	Otero fine sandy loam, 0 to 3 percent slopes	4,848	0.7
34	Otero fine sandy loam, 3 to 6 percent slopes	4,725	0.7
35	Otero fine sandy loam, 6 to 10 percent slopes	1,212	0.2
36	Paoli fine sandy loam, 0 to 3 percent slopes	730	0.1
37	Tassel-Otero-Rock outcrop complex, 10 to 30 percent slopes	18,402	2.6
38	Tassel, thin solum-Tassel-Rock outcrop complex, 10 to 30 percent slopes	13,264	1.9
39	Treon fine sandy loam, 6 to 10 percent slopes	18,090	2.6
40	Treon-Aberone-Treon, thin solum, fine sandy loams, 6 to 15 percent slopes	32,396	4.6
41	Treon, thin solum-Rock outcrop-Treon complex, 15 to 30 percent slopes	9,919	1.4
42	Valent loamy fine sand, 0 to 6 percent slopes	31,804	4.5
43	Valent loamy fine sand, rolling	3,994	0.6
44	Valent-Treon complex, 6 to 10 percent slopes	8,675	1.2
45	Vetal loamy fine sand, 0 to 3 percent slopes	1,867	0.3
46	Vetal loamy fine sand, 3 to 6 percent slopes	912	0.1
47	Vetal fine sandy loam, 0 to 1 percent slopes	2,976	0.4
48	Vetal fine sandy loam, 1 to 3 percent slopes	61,803	8.8
49	Vetal fine sandy loam, 3 to 6 percent slopes	7,160	1.0
50	Wages loam, 0 to 3 percent slopes	14,131	2.0
	Total	699,887	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to crops and pasture are listed]

Soil name and map symbol	Winter wheat		Alfalfa hay		Dry pinto beans		Corn silage		Barley		Irish potatoes	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Lb	Lb	Ton	Ton	Bu	Bu	Cwt	Cwt
1--- Albinas	40	65	---	5.0	---	2,400	---	24	---	75	---	360
2--- Albinas	35	60	---	5.0	---	2,100	---	20	---	75	---	360
3--- Alice	34	60	---	4.5	---	2,100	---	18	---	70	---	400
4--- Alice	32	55	---	4.2	---	1,800	---	18	---	65	---	400
5--- Altvan	32	55	---	4.0	---	2,100	---	18	---	70	---	360
6--- Altvan	25	50	---	4.0	---	1,800	---	18	---	65	---	360
7--- Altvan-Dix	20	35	---	2.5	---	900	---	10	---	35	---	200
8--- Ascalon	40	65	---	5.5	---	2,400	---	24	---	75	---	360
9--- Ascalon	35	60	---	5.0	---	2,100	---	24	---	75	---	360
10--- Ascalon	30	50	---	4.0	---	1,700	---	15	---	60	---	300
11--- Bayard	33	60	---	4.5	---	2,100	---	18	---	70	---	400
12--- Bayard	31	55	---	4.2	---	1,800	---	18	---	65	---	400
13--- Bayard	26	45	---	4.0	---	1,500	---	15	---	55	---	350
15--- Dix-Altvan	15	---	---	---	---	---	---	---	---	---	---	---
17--- Jayem	34	---	---	5.4	---	2,100	---	18	---	70	---	400
18--- Jayem	29	---	---	4.2	---	1,800	---	18	---	65	---	350
19--- Manter	35	---	---	5.5	---	2,100	---	18	35	75	---	400
20--- Manter	30	---	---	4.5	---	1,800	---	15	30	60	---	350
21--- Manter	26	---	---	3.0	---	1,500	---	9	20	50	---	300
25--- Mitchell	32	65	1.7	5.2	---	1,500	---	15	---	70	---	300
26--- Mitchell	29	60	1.5	4.7	---	1,200	---	12	---	65	---	250

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Alfalfa hay		Dry pinto beans		Corn silage		Barley		Irish potatoes	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Lb	Lb	Ton	Ton	Bu	Bu	Cwt	Cwt
27---Mitchell	26	55	1.4	4.1	---	1,200	---	9	---	60	---	200
29---Nucla	35	60	---	4.5	---	2,400	---	20	---	75	---	350
30---Nucla	30	55	---	4.0	---	2,100	---	15	---	70	---	300
31---Nucla-Mitchell	32	65	---	4.8	---	2,400	---	20	---	75	---	350
32---Nucla-Mitchell	26	55	---	4.2	---	2,100	---	15	---	70	---	300
33---Otero	32	65	---	5.0	---	1,800	---	20	---	70	---	350
34---Otero	28	60	---	3.5	---	1,500	---	18	---	65	---	250
35---Otero	25	50	---	2.5	---	1,200	---	13	---	60	---	200
39---Treon	15	---	---	---	---	---	---	---	---	---	---	---
42, 43---Valent	28	---	---	3.5	---	---	---	14	---	60	---	350
45---Vetal	35	65	---	5.0	---	2,100	---	20	---	75	---	400
46---Vetal	33	65	---	4.5	---	1,800	---	18	---	70	---	350
47---Vetal	20	40	2.1	4.0	---	1,200	---	15	---	50	---	250
48, 49---Vetal	15	---	1.8	3.0	---	900	---	10	---	35	---	200
50---Wages	40	65	---	5.5	---	2,400	---	20	---	75	---	360

TABLE 6.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1, 2---------- Albinas	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
3, 4---------- Alice	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Very poor	Good.
5---------- Altvan	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
6---------- Altvan	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
7*:									
Altvan----------	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
Dix----------	Very poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
8, 9, 10---------- Ascalon	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
11, 12, 13--------- Bayard	Fair	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Good.
14---------- Bayard Variant	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
15*:									
Dix----------	Very poor	Very poor.	Very poor	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
Altvan----------	Poor	Fair	Good	Good	Very poor.	Very poor.	Fair	Very poor	Good.
16*:									
Dix----------	Very poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Otero----------	Poor	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
17, 18---------- Jayem	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
19, 20---------- Manter	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
21---------- Manter	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
22---------- Manter Variant	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor	Fair.
23---------- Merden	Very poor	Poor	Good	Good	Good	Fair	Poor	Fair	Good.
24---------- Merden Variant	Very poor	Poor	Good	Good	Fair	Poor	Poor	Poor	Good.
25, 26, 27--------- Mitchell	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
28*:									
Mitchell Variant--	Poor	Poor	---	---	Poor	Very poor.	Poor	Very poor	---
Tassel Variant----	Poor	Poor	---	---	Poor	Very poor.	Poor	Very poor	---
29, 30---------- Nucla	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
31*, 32*:									
Nucla----------	Very poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Mitchell----------	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
33, 34, 35--------- Otero	Poor	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
36---------- Paoli	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
37*:									
Tassel----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Otero----------	Poor	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Rock outcrop.									
38*:									
Tassel----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Tassel----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Rock outcrop.									
39---------- Treon	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
40*:									
Treon----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Aberone----------	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor	Fair.
Treon----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
41*:									
Treon----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Rock outcrop.									
Treon----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
42, 43---------- Valent	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
44*:									
Valent	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Treon	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
45, 46, 47, 48, 49-Vetal	Poor	Fair	Good	---	Very poor.	Very poor.	Poor	Very poor	Good.
50 Wages	Good	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor	Fair.

* 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	Lawns and landscaping
1, 2--Albinas	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
3--Alice	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
4--Alice	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
5--Altvan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
6--Altvan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
7*:						
Altvan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Dix	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
8, 9--Ascalon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
10--Ascalon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
11--Bayard	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
12--Bayard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
13--Bayard	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
14--Bayard Variant	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
15*:						
Dix	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty.
Altvan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
16*:						
Dix	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Otero	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
17--Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
18--Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.

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	Lawns and landscaping
19---------- Manter	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
20---------- Manter	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
21---------- Manter	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
22---------- Manter Variant	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.
23---------- Merden	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
24---------- Merden Variant	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
25---------- Mitchell	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
26---------- Mitchell	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
27---------- Mitchell	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
28*: Mitchell Variant-	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Severe: frost action.	Severe: excess salt.
Tassel Variant---	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: frost action.	Severe: excess salt, thin layer.
29---------- Nucla	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
30---------- Nucla	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
31*: Nucla----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
Mitchell---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
32*: Nucla----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
Mitchell---------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
33---------- Otero	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
34---------- Otero	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.

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	Lawns and landscaping
35---------- Otero	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
36---------- Paoli	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
37*:						
Tassel----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Otero----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Rock outcrop.						
38*:						
Tassel----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Tassel----------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.
Rock outcrop.						
39---------- Treon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Severe: thin layer.
40*:						
Treon----------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Severe: thin layer.
Aberone----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Treon----------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Severe: thin layer.
41*:						
Treon----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop.						
Treon----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
42---------- Valent	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
43---------- Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

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	Lawns and landscaping
44*:						
Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Treon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Severe: thin layer.
45 Vetal	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
46 Vetal	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
47, 48 Vetal	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
49 Vetal	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
50 Wages	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.

* 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," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill
1 Albinas	Moderate: percs slowly.	Moderate: seepage.	Slight.
2 Albinas	Moderate: percs slowly.	Moderate: seepage, slope.	Slight.
3, 4 Alice	Slight	Severe: seepage.	Severe: seepage.
5, 6 Altvan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.
7*: Altvan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.
Dix	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.
8, 9, 10 Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.
11, 12 Bayard	Slight	Severe: seepage.	Severe: seepage.
13 Bayard	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.
14 Bayard Variant	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.
15*: Dix	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.
Altvan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.
16*: Dix	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.
Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.
17, 18 Jayem	Slight	Severe: seepage.	Severe: seepage.
19, 20 Manter	Severe: poor filter.	Severe: seepage.	Severe: seepage.

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
21--- Manter	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.
22--- Manter Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.
23--- Merden	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.
24--- Merden Variant	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.
25--- Mitchell	Slight	Moderate: seepage.	Slight.
26--- Mitchell	Slight	Moderate: seepage, slope.	Slight.
27--- Mitchell	Moderate: slope.	Severe: slope.	Moderate: slope.
28*: Mitchell Variant---	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.
Tassel Variant-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
29--- Nucla	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.
30--- Nucla	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.
31*: Nucla---	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.
Mitchell-----	Slight	Moderate: seepage.	Slight.
32*: Nucla---	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.
Mitchell-----	Slight	Moderate: seepage, slope.	Slight.
33, 34--- Otero	Slight	Severe: seepage.	Slight.
35--- Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.
36--- Paoli	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage.

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
37*:			
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.
Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.
Rock outcrop.			
38*:			
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.
Tassel	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.
Rock outcrop.			
39--- Treon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.
40*:			
Treon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.
Aberone	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.
Treon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.
41*:			
Treon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.
Rock outcrop.			
Treon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.
42--- Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.
43--- Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.
44*:			
Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.

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
44*: Treon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.
45, 46, 47, 48, 49--Vetal	Slight	Severe: seepage.	Severe: seepage.
50--Wages	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.

* 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," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2---- Albinas	Good----	Improbable: excess fines.	Improbable: excess fines.	Good.
3, 4---- Alice	Good----	Improbable: excess fines.	Improbable: excess fines.	Good.
5, 6---- Altvan	Good----	Probable----	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
7*:				
Altvan----	Good----	Probable----	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
Dix----	Good----	Probable----	Probable----	Poor: area reclaim, small stones.
8, 9, 10---- Ascalon	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
11, 12---- Bayard	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
13---- Bayard	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
14---- Bayard Variant	Good----	Improbable: excess fines.	Improbable: excess fines.	Good.
15*:				
Dix----	Fair: slope.	Probable----	Probable----	Poor: area reclaim, small stones, slope.
Altvan----	Good----	Probable----	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
16*:				
Dix----	Good----	Probable----	Probable----	Poor: area reclaim, small stones.
Otero----	Good----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
17, 18---- Jayem	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
19, 20---- Manter	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
21---- Manter	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22--Manter Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
23--Merden	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
24--Merden Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
25, 26--Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
27--Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
28*:				
Mitchell Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
Tassel Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, excess salt.
29, 30--Nucla	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
31*, 32*:				
Nucla	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
33, 34, 35--Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
36--Paoli	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
37*:				
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Rock outcrop.				
38*:				
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Rock outcrop.				
39--Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
40*:				
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
40*:				
Aberone	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
41*:				
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
42 Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
43 Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
44*:				
Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
45, 46, 47, 48, 49 Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
50 Wages	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

* 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. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for pond reservoir areas	Features affecting--		
		Drainage	Irrigation	Grassed waterways
1, 2---------- Albinas	Moderate: seepage.	Deep to water--------	Favorable----------	Erodes easily.
3, 4---------- Alice	Severe: seepage.	Deep to water--------	Soil blowing---------	Favorable.
5---------- Altvan	Severe: seepage.	Deep to water--------	Favorable----------	Favorable.
6---------- Altvan	Severe: seepage.	Deep to water--------	Slope----------	Favorable.
7*: Altvan----------	Severe: seepage, slope.	Deep to water--------	Slope----------	Slope.
Dix----------	Severe: seepage, slope.	Deep to water--------	Droughty, fast intake.	Slope, droughty.
8, 9---------- Ascalon	Severe: seepage.	Deep to water--------	Favorable----------	Favorable.
10---------- Ascalon	Severe: seepage.	Deep to water--------	Slope----------	Favorable.
11---------- Bayard	Severe: seepage.	Deep to water--------	Favorable----------	Favorable.
12---------- Bayard	Severe: seepage.	Deep to water--------	Slope----------	Favorable.
13---------- Bayard	Severe: seepage, slope.	Deep to water--------	Slope----------	Slope.
14---------- Bayard Variant	Severe: seepage.	Deep to water--------	Soil blowing, flooding.	Favorable.
15*: Dix----------	Severe: seepage, slope.	Deep to water--------	Droughty, fast intake.	Slope, droughty.
Altvan----------	Severe: seepage, slope.	Deep to water--------	Slope----------	Slope.
16*: Dix----------	Severe: seepage, slope.	Deep to water--------	Droughty, fast intake.	Slope, droughty.
Otero----------	Severe: seepage, slope.	Deep to water--------	Droughty, soil blowing.	Slope, droughty.
17---------- Jayem	Severe: seepage.	Deep to water--------	Soil blowing---------	Favorable.
18---------- Jayem	Severe: seepage.	Deep to water--------	Soil blowing, slope.	Favorable.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for pond reservoir areas	Features affecting--		
		Drainage	Irrigation	Grassed waterways
19, 20---------- Manter	Severe: seepage.	Deep to water--------	Soil blowing---------	Favorable.
21---------- Manter	Severe: seepage, slope.	Deep to water--------	Soil blowing---------	Slope.
22---------- Manter Variant	Severe: depth to rock.	Deep to water--------	Soil blowing, depth to rock.	Depth to rock.
23---------- Merden	Moderate: seepage.	Flooding, frost action.	Wetness, flooding.	Erodes easily.
24---------- Merden Variant	Slight----------	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.
25---------- Mitchell	Moderate: seepage.	Deep to water--------	Favorable----------	Erodes easily.
26---------- Mitchell	Moderate: seepage, slope.	Deep to water--------	Slope----------	Erodes easily.
27---------- Mitchell	Severe: slope.	Deep to water--------	Slope----------	Slope, erodes easily.
28*: Mitchell Variant----	Moderate: seepage, depth to rock.	Deep to water--------	Soil blowing, depth to rock, excess salt.	Excess salt, erodes easily, depth to rock.
Tassel Variant------	Severe: depth to rock.	Deep to water--------	Soil blowing, depth to rock, excess salt.	Excess salt, erodes easily, depth to rock.
29---------- Nucla	Moderate: seepage.	Deep to water--------	Favorable----------	Favorable.
30---------- Nucla	Moderate: seepage, slope.	Deep to water--------	Slope----------	Favorable.
31*: Nucla----------	Moderate: seepage.	Deep to water--------	Favorable----------	Favorable.
Mitchell----------	Moderate: seepage.	Deep to water--------	Soil blowing---------	Erodes easily.
32*: Nucla----------	Moderate: seepage, slope.	Deep to water--------	Slope----------	Favorable.
Mitchell----------	Moderate: seepage, slope.	Deep to water--------	Soil blowing, slope.	Erodes easily.
33, 34---------- Otero	Severe: seepage.	Deep to water--------	Droughty, soil blowing.	Droughty.
35---------- Otero	Severe: seepage, slope.	Deep to water--------	Droughty, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for pond reservoir areas	Features affecting--		
		Drainage	Irrigation	Grassed waterways
36---------- Paoli	Severe: seepage.	Deep to water--------	Soil blowing----------	Favorable.
37*:				
Tassel----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
Otero----------	Severe: seepage, slope.	Deep to water--------	Droughty, soil blowing.	Slope, droughty.
Rock outcrop.				
38*:				
Tassel----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
Tassel----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
Rock outcrop.				
39---------- Treon	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
40*:				
Treon----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
Aberone----------	Severe: seepage, slope.	Deep to water--------	Droughty, soil blowing, slope.	Large stones, slope, droughty.
Treon----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
41*:				
Treon----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
Rock outcrop.				
Treon----------	Severe: depth to rock, slope.	Deep to water--------	Soil blowing, depth to rock, slope.	Slope, depth to rock.
42---------- Valent	Severe: seepage.	Deep to water--------	Droughty, fast intake, soil blowing.	Droughty.
43---------- Valent	Severe: seepage, slope.	Deep to water--------	Droughty, fast intake, soil blowing.	Slope, droughty.
44*:				
Valent----------	Severe: seepage, slope.	Deep to water--------	Droughty, fast intake, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for Pond reservoir areas	Features affecting--		
		Drainage	Irrigation	Grassed waterways
44*: Treon	Severe: depth to rock, slope.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.
45, 46--- Vetal	Severe: seepage.	Deep to water	Soil blowing	Favorable.
47, 48--- Vetal	Severe: seepage.	Deep to water	Soil blowing	Favorable.
49--- Vetal	Severe: seepage.	Deep to water	Soil blowing, slope.	Favorable.
50--- Wages	Moderate: seepage.	Deep to water	Favorable	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1, 2---------- Albinas	0-4	Loam----------	ML	A-4	0	100	95-100	80-100	50-75	20-30	NP-5
	4-32	Sandy clay loam, clay loam.	SC, CL	A-6	0	100	95-100	80-100	40-80	30-40	10-20
	32-60	Loam, silty loam, fine sandy loam.	CL-ML, ML	A-4	0	100	95-100	60-95	50-75	20-30	5-10
3---------- Alice	0-4	Fine sandy loam	SM, ML	A-4	0	100	95-100	95-100	45-60	20-30	NP-5
	4-25	Fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	15-25	NP-5
	25-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	15-25	NP-5
4---------- Alice	0-4	Fine sandy loam	SM, ML	A-4	0	100	95-100	95-100	45-60	20-30	NP-5
	4-25	Fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	15-25	NP-5
	25-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	15-25	NP-5
5, 6---------- Altvan	0-9	Loam----------	ML	A-4	0	100	100	85-100	60-90	25-35	NP-10
	9-25	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	25-28	Loam, fine sandy loam, sandy clay loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	NP-10
	28-60	Very gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	55-95	45-90	25-35	0-10	---	NP
7*:											
Altvan----------	0-9	Loam----------	ML	A-4	0	100	100	85-100	60-90	25-35	NP-10
	9-25	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	25-28	Loam, fine sandy loam, sandy clay loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	NP-10
	28-60	Very gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	55-95	45-90	25-35	0-10	---	NP
Dix----------	0-10	Very gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0	50-80	45-75	25-70	10-50	---	NP
	10-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
8, 9, 10--------- Ascalon	0-5	Loam----------	ML	A-4	0	95-100	95-100	85-90	50-70	20-25	NP-5
	5-21	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	21-38	Sandy clay loam, loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	5-15
	38-60	Fine sandy loam, sandy clay loam, loam.	SM-SC	A-2	0	95-100	95-100	70-95	20-35	15-25	5-10

See footnote at end of table.

TABLE 11.--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	
11, 12, 13------- Bayard	0-16 16-60	Fine sandy loam Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, ML ML, SM	A-4, A-2 A-2, A-4	0 0	90-100 90-100	80-100 80-100	60-85 60-85	30-60 30-60	--- ---	NP NP
14--------------- Bayard Variant	0-10 10-60	Fine sandy loam Sandy loam--------	SM SM	A-4 A-4	0 0	95-100 100	95-100 100	70-85 70-85	35-45 35-45	--- ---	NP NP
15*: Dix----------	0-10	Very gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0	50-80	45-75	25-70	10-50	---	NP
	10-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
Altvan----------	0-9	Loam----------	ML	A-4	0	100	100	85-100	60-90	25-35	NP-10
	9-25	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	25-28	Loam, fine sandy loam, sandy clay loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	NP-10
	28-60	Very gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	55-95	45-90	25-35	0-10	---	NP
16*: Dix----------	0-10	Very gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0	50-80	45-75	25-70	10-50	---	NP
	10-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
Otero----------	0-2	Fine sandy loam	SM	A-2	0-1	95-100	75-100	50-80	10-35	20-25	NP-5
	2-60	Sandy loam, fine sandy loam.	SM	A-2, A-1	0-1	90-100	75-100	40-80	20-35	15-25	NP-5
17, 18---------- Jayem	0-40 40-60	Fine sandy loam Fine sandy loam, sandy loam.	SM SM, ML	A-4, A-2 A-4	0 0	85-100 85-100	75-100 75-100	55-95 70-90	25-50 40-60	20-25 15-25	NP-5 NP-5
19, 20, 21------- Manter	0-7 7-25	Sandy loam------- Fine sandy loam, sandy loam.	SM, ML SM, ML, CL-ML, SM-SC	A-2, A-4 A-2, A-4	0 0	95-100 95-100	75-100 75-100	45-85 50-85	25-55 30-55	--- 15-25	NP NP-5
	25-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
22--------------- Manter Variant	0-11 11	Fine sandy loam Unweathered bedrock.	SM ---	A-2 ---	0 ---	95-100 ---	95-100 ---	60-75 ---	25-35 ---	--- ---	NP ---
23--------------- Merden	0-20 20-60	Loam---------- Loam, very fine sandy loam.	ML ML	A-4 A-4	0 0	100 100	100 100	85-95 85-95	60-75 60-75	--- ---	NP NP
24--------------- Merden Variant	0-10 10-60	Silty clay loam Silty clay loam, silty clay, clay loam.	CL CL	A-6, A-7 A-6, A-7	0 0	100 100	100 100	95-100 95-100	95-100 95-100	35-45 35-45	15-20 15-20

See footnote at end of table.

TABLE 11.--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	
25, 26, 27------- Mitchell	0-3	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	65-95	20-35	NP-10
	3-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	100	85-100	65-100	20-35	NP-10
28*:											
Mitchell Variant	0-3	Fine sandy loam	SM	A-2	0	95-100	95-100	55-70	25-35	---	NP
	3-17	Fine sandy loam, sandy loam, very fine sandy loam.	ML, SM	A-4	0	95-100	95-100	70-85	40-60	20-25	NP-5
	17-32	Silt loam--------	ML	A-4	0	95-100	95-100	85-95	85-95	20-30	NP-5
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel Variant--	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	60-75	35-45	---	NP
	5-15	Silt loam, silty clay loam, loam.	ML	A-4	0	95-100	95-100	85-95	85-95	20-30	NP-5
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
29, 30---------- Nucla	0-2	Fine sandy loam	ML, SM	A-4	0-5	80-100	75-100	60-90	45-70	20-30	NP-5
	2-60	Loam, silt loam, fine sandy loam.	CL-ML, SM-SC	A-4	0-5	80-100	75-100	60-80	40-60	20-30	5-10
31*, 32*:											
Nucla----------	0-2	Fine sandy loam	ML, SM	A-4	0-5	80-100	75-100	60-90	45-70	20-30	NP-5
	2-60	Loam, silt loam, fine sandy loam.	CL-ML, SM-SC	A-4	0-5	80-100	75-100	60-80	40-65	20-30	5-10
Mitchell--------	0-3	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	100	100	70-95	40-55	15-25	NP-10
	3-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	100	85-100	65-100	20-35	NP-10
33, 34, 35------- Otero	0-2	Fine sandy loam	SM	A-2	0-1	95-100	75-100	50-80	10-35	20-25	NP-5
	2-60	Sandy loam, fine sandy loam.	SM	A-2, A-1	0-1	90-100	75-100	40-80	20-35	15-25	NP-5
36---------- Paoli	0-7	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-85	40-60	---	NP
	7-38	Fine sandy loam, sandy loam.	SM	A-4	0	80-100	80-100	60-85	35-50	---	NP
	38-60	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	75-100	75-100	55-85	30-50	---	NP
37*:											
Tassel----------	0-12	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	25-35	NP-10
	12-15	Fine sandy loam, loamy very fine sand, loamy fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	25-35	NP-10
	15-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Otero----------	0-2	Fine sandy loam	SM	A-2	0-1	95-100	75-100	50-80	10-35	20-25	NP-5
	2-60	Sandy loam, fine sandy loam.	SM	A-2, A-1	0-1	90-100	75-100	40-80	20-35	15-25	NP-5
Rock outcrop.											
38*:											
Tassel----------	0-9	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	25-35	NP-10
	9-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tassel----------	0-12	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	25-35	NP-10
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 11.--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	
39---------- Treon	0-14	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
40*:											
Treon----------	0-14	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
Aberone---------	0-5	Fine sandy loam	SM	A-4	0	90-100	90-100	60-80	35-45	---	NP
	5-18	Sandy loam, fine sandy loam.	SM	A-4	0	90-100	90-100	60-80	35-45	---	NP
	18-60	Very gravelly sandy loam, extremely gravelly sandy loam.	GM, GP-GM	A-1, A-2	25-45	30-60	15-50	10-45	5-35	---	NP
Treon----------	0-10	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	10	Weathered bedrock	---	---	---	---	---	---	---	---	---
41*:											
Treon----------	0-10	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	10	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Treon----------	0-14	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
42, 43---------- Valent	0-60	Loamy fine sand	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
44*:											
Valent----------	0-60	Loamy fine sand	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
Treon----------	0-14	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
45, 46---------- Vetal	0-10	Loamy fine sand	SM	A-2, A-4	0	100	100	85-100	30-45	20-30	NP
	10-60	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-10
47, 48, 49------- Vetal	0-27	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	85-100	40-55	20-30	NP-10
	27-60	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-10
50---------- Wages	0-4	Loam----------	CL-ML	A-4	0	90-100	75-100	65-90	60-75	20-30	5-10
	4-13	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	13-20	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	15-30	5-15
	20-60	Sandy loam, gravelly sandy loam, gravelly loam.	SM, GM, ML	A-2, A-1, A-4	0-5	60-90	50-85	30-70	20-55	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
1, 2----------	0-4	15-20	0.6-2.0	0.15-0.20	6.6-7.8	<2	Low--------	0.32	5	6	2-4
Albinas	4-32	20-35	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.28			
	32-60	10-20	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.43			
3----------	0-4	7-20	0.6-6.0	0.16-0.22	6.6-8.4	<2	Low--------	0.20	5	3	1-3
Alice	4-25	5-18	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.20			
	25-60	5-20	2.0-6.0	0.08-0.19	7.4-8.4	<2	Low--------	0.20			
4----------	0-4	7-20	0.6-6.0	0.16-0.22	6.6-8.4	<2	Low--------	0.20	5	3	1-3
Alice	4-25	5-18	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.20			
	25-60	5-20	0.6-6.0	0.08-0.19	7.4-8.4	<2	Low--------	0.20			
5, 6----------	0-9	16-23	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.28	4	5	1-2
Altvan	9-25	20-35	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	25-28	8-15	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low--------	0.32			
	28-60	0-5	>20	0.02-0.04	7.4-8.4	<2	Low--------	0.10			
7*:											
Altvan----------	0-9	16-23	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.28	4	5	1-2
	9-25	20-35	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	25-28	8-15	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low--------	0.32			
	28-60	0-5	>20	0.02-0.04	7.4-9.0	<2	Low--------	0.10			
Dix----------	0-10	5-12	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.17	2	8	1-2
	10-60	0-3	>20	0.02-0.04	6.6-8.4	<2	Low--------	0.10			
8, 9, 10----------	0-5	10-18	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.28	5	5	1-2
Ascalon	5-21	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	21-38	25-30	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	0.20			
	38-60	10-25	2.0-6.0	0.09-0.13	7.9-9.0	<2	Low--------	0.17			
11, 12, 13--------	0-16	10-18	2.0-6.0	0.12-0.18	6.6-7.8	<2	Low--------	0.20	5	3	1-3
Bayard	16-60	10-18	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low--------	0.20			
14----------	0-10	10-15	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.32	5	3	1-3
Bayard Variant	10-60	10-15	2.0-6.0	0.11-0.13	6.6-7.8	<2	Low--------	0.28			
15*:											
Dix----------	0-10	5-12	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.17	2	8	1-2
	10-60	0-3	>20	0.02-0.04	6.6-8.4	<2	Low--------	0.10			
Altvan----------	0-9	16-23	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.28	4	5	1-2
	9-25	20-35	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	25-28	8-15	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low--------	0.32			
	28-60	0-5	>20	0.02-0.04	7.4-8.4	<2	Low--------	0.10			
16*:											
Dix----------	0-10	5-12	6.0-20	0.10-0.12	6.1-7.8	<2	Low--------	0.17	2	8	1-2
	10-60	0-3	>20	0.02-0.04	6.6-8.4	<2	Low--------	0.10			
Otero----------	0-2	10-20	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low--------	0.20	5	3	.5-2
	2-60	5-18	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low--------	0.17			
17, 18----------	0-40	5-15	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.28	5	3	1-3
Jayem	40-60	5-15	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low--------	0.28			
19, 20, 21--------	0-7	10-20	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low--------	0.15	5	3	2-4
Manter	7-25	9-18	6.0-20	0.11-0.14	6.6-7.8	<2	Low--------	0.15			
	25-60	5-15	6.0-20	0.08-0.14	7.9-8.4	<2	Low--------	0.15			
22----------	0-11	5-18	2.0-6.0	0.12-0.15	6.6-7.8	<2	Low--------	0.28	2	3	1-3
Manter Variant	11	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
23----------	0-20	18-27	0.6-2.0	0.15-0.18	>8.4	<4	Low--------	0.32	5	8	1-3
Merden	20-60	18-27	0.6-2.0	0.15-0.18	7.9-9.0	<4	Low--------	0.37			
24----------	0-10	27-35	0.06-0.2	0.19-0.21	8.5-9.0	<4	Moderate	0.37	5	7	1-3
Merden Variant	10-60	27-35	0.06-0.2	0.14-0.16	7.9-9.0	<8	Moderate	0.43			
25, 26, 27-------	0-3	10-20	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43	5	4L	.5-1
Mitchell	3-60	8-18	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
28*:											
Mitchell Variant	0-3	5-15	2.0-6.0	0.13-0.15	>8.4	8-16	Low--------	0.32	3	3	<1
	3-17	8-18	0.6-2.0	0.15-0.19	>8.4	8-16	Low--------	0.32			
	17-32	10-18	0.6-2.0	0.19-0.21	>8.4	8-16	Low--------	0.43			
	32	---	---	---	---	---	----------	----			
Tassel Variant--	0-5	5-15	2.0-6.0	0.13-0.15	>8.4	8-16	Low--------	0.32	2	3	<1
	5-15	15-30	0.6-2.0	0.19-0.21	>8.4	8-16	Low--------	0.43			
	15	---	---	---	---	---	----------	----			
29, 30----------	0-2	15-25	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.28	5	4L	1-2
Nucla	2-60	18-27	0.6-2.0	0.16-0.18	7.4-8.4	<2	Moderate	0.32			
31*, 32*:											
Nucla----------	0-2	15-25	0.6-2.0	0.13-0.18	6.6-8.4	<2	Low--------	0.28	5	4L	1-2
	2-60	18-35	0.6-2.0	0.16-0.18	7.4-8.4	<2	Moderate	0.32			
Mitchell--------	0-3	5-15	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	5	3	.5-1
	3-60	8-18	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
33, 34, 35-------	0-2	10-20	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low--------	0.20	5	3	.5-2
Otero	2-60	5-18	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low--------	0.17			
36----------	0-7	10-20	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low--------	0.17	5	3	2-4
Paoli	7-38	8-18	6.0-20	0.14-0.17	7.4-8.4	<2	Low--------	0.20			
	38-60	8-18	6.0-20	0.12-0.14	7.4-8.4	<2	Low--------	0.20			
37*:											
Tassel----------	0-12	5-12	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	3	.5-1
	12	---	---	---	---	---	----------	----			
Otero----------	0-2	10-20	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low--------	0.20	5	3	.5-2
	2-60	5-18	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low--------	0.17			
Rock outcrop.											
38*:											
Tassel----------	0-9	5-12	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	3	.5-1
	9	---	---	---	---	---	----------	----			
Tassel----------	0-12	5-12	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	3	.5-1
	12	---	---	---	---	---	----------	----			
Rock outcrop.											
39----------	0-14	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low--------	0.28	1	3	2-4
Treon	14	---	---	---	---	---	----------	----			
40*:											
Treon----------	0-14	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low--------	0.28	1	3	2-4
	14	---	---	---	---	---	----------	----			
Aberone----------	0-5	5-15	2.0-6.0	0.12-0.14	7.4-8.4	<2	Low--------	0.20	2	3	2-3
	5-18	5-18	2.0-6.0	0.12-0.14	7.4-8.4	<2	Low--------	0.24			
	18-60	5-18	2.0-6.0	0.02-0.04	7.9-9.0	<2	Low--------	0.15			
Treon----------	0-10	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low--------	0.28	1	3	2-4
	10	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
41*:											
Treon	0-10	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28	1	3	2-4
	10	---	---	---	---	---	---	---			
Rock outcrop.											
Treon	0-14	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28	1	3	2-4
	14	---	---	---	---	---	---	---			
42, 43 Valent	0-60	3-10	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.10	5	1	.5-1
44*:											
Valent	0-60	3-10	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.10	5	1	.5-1
Treon	0-14	10-20	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28	1	3	2-4
	14	---	---	---	---	---	---	---			
45, 46 Vetal	0-10	5-10	6.0-20	0.08-0.11	6.6-7.8	<2	Low	0.10	5	2	1-3
	10-60	12-18	2.0-6.0	0.11-0.19	6.6-7.8	<2	Low	0.20			
47, 48, 49 Vetal	0-27	10-18	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low	0.20	5	3	1-3
	27-36	12-18	2.0-6.0	0.11-0.19	6.6-7.8	<2	Low	0.20			
	36-60	10-18	2.0-6.0	0.10-0.17	7.4-8.4	<2	Low	0.20			
50 Wages	0-4	15-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	5	5	2-4
	4-13	20-35	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.24			
	13-20	15-35	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low	0.24			
	20-60	12-20	2.0-6.0	0.07-0.11	7.9-8.4	<2	Low	0.17			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. 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			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1, 2---- Albinas	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
3, 4---- Alice	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
5, 6---- Altvan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
7*:												
Altvan----	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Dix----	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
8, 9, 10---- Ascalon	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
11, 12, 13---- Bayard	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
14---- Bayard Variant	B	Occasional	Brief	Jun-Aug	2.5-5.0	Apparent	Apr-Nov	>60	---	Low	High	Moderate.
15*:												
Dix----	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Altvan----	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
16*:												
Dix----	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Otero----	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
17, 18---- Jayem	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
19, 20, 21---- Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
22---- Manter Variant	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
23---- Merden	D	Frequent	Long	Apr-May	1.5-3.0	Apparent	Apr-Nov	>60	---	High	High	Low.
24---- Merden Variant	D	Occasional	Brief	Apr-Aug	1.0-3.0	Apparent	Jan-Dec	>60	---	High	High	High.
25, 26, 27---- Mitchell	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
28*:												
Mitchell Variant-	B	None	---	---	>6.0	---	---	20-40	Soft	High	High	High.
Tassel Variant---	D	None	---	---	>6.0	---	---	10-20	Soft	High	High	High.
29, 30---------- Nucla	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
31*, 32*:												
Nucla----------	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Mitchell---------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
33, 34, 35-------- Otero	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
36---------- Paoli	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
37*:												
Tassel----------	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Otero----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Rock outcrop.												
38*:												
Tassel----------	D	None	---	---	>6.0	---	---	6-10	Soft	Low	High	Low.
Tassel----------	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Rock outcrop.												
39---------- Treon	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
40*:												
Treon----------	D	None	---	---	>6.0	---	---	6-20	Soft	Moderate	High	Low.
Aberone----------	B	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Treon----------	D	None	---	---	>6.0	---	---	6-10	Soft	Moderate	High	Low.
41*:												
Treon----------	D	None	---	---	>6.0	---	---	6-10	Soft	Moderate	High	Low.
Rock outcrop.												
Treon----------	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
42, 43---------- Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
44*:												
Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Treon	D	None	---	---	>6.0	---	---	6-20	Soft	Moderate	High	Low.
45, 46, 47, 48, 49--- Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
50--- Wages	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aberone	Loamy-skeletal, carbonatic, mesic Aridic Haplustolls
Albinas	Fine-loamy, mixed, mesic Pachic Argiustolls
Alice	Coarse-loamy, mixed, mesic Aridic Haplustolls
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Bayard	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Bayard Variant	Coarse-loamy, mixed, mesic Torrifluventic Haplustolls
Dix	Sandy-skeletal, mixed, mesic Torriorthentic Haplustolls
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Manter Variant	Loamy, mixed, mesic, shallow Aridic Argiustolls
Merden	Fine-loamy, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Merden Variant	Fine-silty, mixed (calcareous); mesic Fluvaquentic Haplaquolls
Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Mitchell Variant	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nucla	Fine-loamy, mixed, mesic Torriorthentic Haplustolls
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Paoli	Coarse-loamy, mixed, mesic Pachic Haplustolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Tassel Variant	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Treon	Loamy, mixed, mesic, shallow Torriorthentic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Wages	Fine-loamy, mixed, mesic Aridic Argiustolls

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