



United States  
Department of  
Agriculture

Natural Resources  
Conservation  
Service

In cooperation with the  
Wyoming Agricultural  
Experiment Station and the  
United States Department  
of Interior - Bureau of Land  
Management

# Soil Survey of Niobrara County, Wyoming





# How to Use This Soil Survey

## General Soil Map

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

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

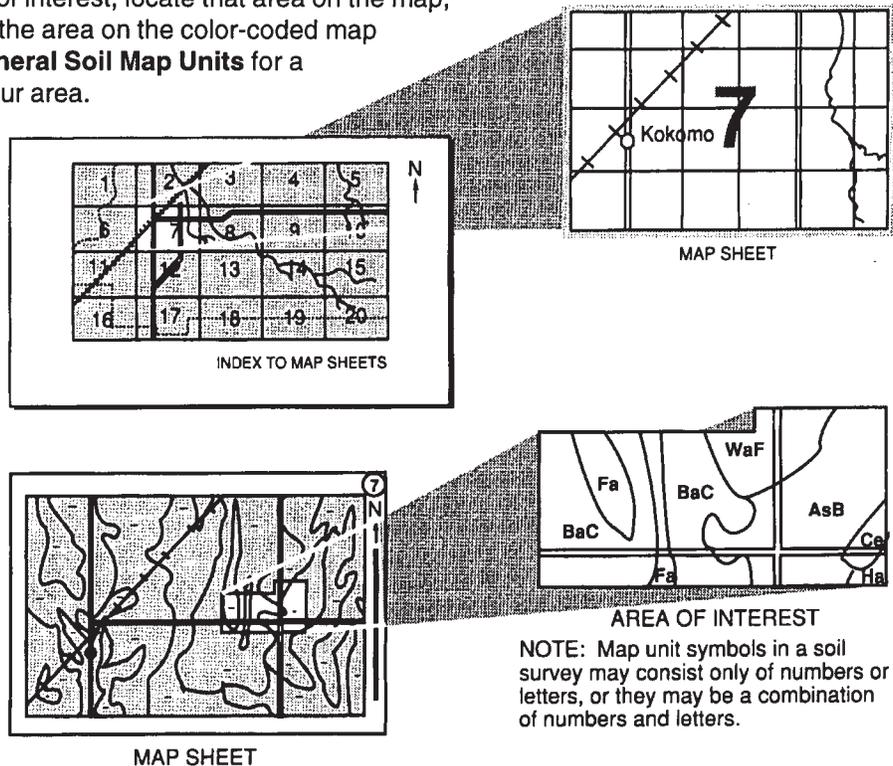
## Detailed Soil Maps

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

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

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

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



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This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. 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, handicap, or age.

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service, Wyoming Agricultural Experiment Station, and the Bureau of Land Management. It is part of the technical assistance furnished to the Niobrara 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: Hat Creek Breaks. The map unit of Ustic Torriorthents, cool-Torriorthentic Haplustolls - Rock outcrop complex, 6 to 60 percent slopes, occurs on the ponderosa pine covered hillslopes. The map unit of Jayem-Phiferson-Trelona fine sandy loams, 3 to 10 percent slopes, occurs on the grass covered hills below the very steep hillslopes.**

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

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# Foreword

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This soil survey contains information that can be used in land-planning programs in Niobrara County, Wyoming. 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 Natural Resources Conservation Service or the Cooperative Extension Service.

Lincoln E. Burton  
State Conservationist  
Natural Resources Conservation Service



# Soil Survey of Niobrara County, Wyoming

By Gordon F. Kee, Jr., Natural Resources Conservation Service

Fieldwork by Gordon F. Kee, Jr., James W. Westerman, Roy J. Larsen, Stephen C. Depew, Richard L. Smith, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Wyoming Agricultural Experiment Station and the United States Department of Interior, Bureau of Land Management.

## General Nature and History of the Area

NIORRARA COUNTY is located in the east-central part of Wyoming (fig. 1) with South Dakota and Nebraska on the eastern border. Weston County borders to the north, Converse County to the west, with Goshen and Platte Counties making up the southern border.

There are 1,718,048 acres in the county of which 1,458,383 are privately owned. Federally administered land totals 124,885 acres, and there are 134,780 acres of state land.

Most of Niobrara County is rolling prairie, although there is a ridge of pine and cedar covered hills, known as the Hat Creek Breaks, that run east to west through the south central part of the county. The Hat Creek Breaks make a climatic division. Land that is south of the breaks receives 15 to 17 inches of precipitation while north of the breaks the land is 1,000 feet lower in elevation and receives 10 to 14 inches of precipitation.

Elevations range from 6,100 feet in the Rawhide Buttes to 3,600 feet in the northeast corner of the county. The elevation at Lusk is 5,015 feet and it is 5,280 feet at Manville. The majority of the county ranges from 3,800 to 5,000 feet.

Most of the drainage in the county is to the northeast and east in the northern two-thirds of the survey area and to the east and southeast in the southern one-third. The Cheyenne River flows in an easterly pattern in the northern part of the county. Major small streams include Lance Creek, Twentymile Creek, and Lightning Creek in the northern part of the survey area and the Niobrara River in the southern part.

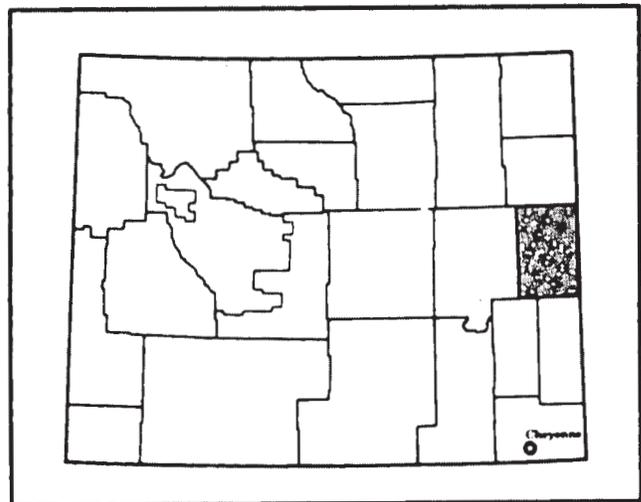


Figure 1. Location of Niobrara County in Wyoming.

The area known as Niobrara County has had a rich and colorful past. The northern part of the survey area contained petrified skeletons of dinosaurs, dawn-horses, small camels, and saber-toothed tigers. Many of the fossils are now on display in eastern museums.

In the early to mid 1800s Niobrara County grasslands supported herds of buffalo and was a favored hunting ground for Native Americans. Teepee rings are still visible on the plains and lend credence to the fact that this area was indeed one of the final frontiers of the American West.

In the early 1880's the Great Western Mining and Milling Co. operated mines and a smelter on what is known as the "Mining Hills" just west of the present town of Lusk, in a quest for silver and copper. By 1886 very little work was being done, as the pay ore was

not found in the mine in sufficient quantities, but men of foresight realized a town there, or nearby, would point toward a steady growth in the area as a cattle shipping point. After much watching and waiting, the railroad reached Lusk on July 13, 1886. The town of Lusk was named after railroad representative, Frank S. Lusk.

Lusk continued to grow, and the surrounding country began to be settled. The railroad played a natural part. The Cheyenne and Black Hills Stage Line must also be credited.

In 1888 the County of Laramie was divided and Lusk was then in the new county of Converse. In 1890, Wyoming Territory was admitted as the 44th state in the Union. In 1911, the legislature divided Converse County into Converse and Niobrara Counties.

## Climate

The climate of the survey area is semi-arid. The high elevation and dry air contribute to the wide differences between the daily maximum and minimum temperatures. The high elevation and northern latitude result in a wide difference in winter and summer temperatures. Abrupt changes in the weather are common. The lowest temperatures occur when cold air masses from Canada flow into the area.

Tables 1A, 1B, and 1C give data on temperature and precipitation for various stations in the survey area. Tables 2A, 2B, and 2C show probable dates of the first freeze in fall and the last freeze in spring. Tables 3A, 3B, and 3C provide data on length of the growing season.

In winter, the average temperature is 27.3 degrees F and the average daily minimum temperature is 14.9 degrees. The lowest temperature recorded at Lusk is 38 degrees below zero. In summer, the average temperature is 47.6 degrees and the average daily maximum temperature is 78.9 degrees. The highest temperature recorded at Lusk is 105 degrees.

Growing degree days are shown in tables 1A, 1B, and 1C. 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 at Lusk is 15.35 inches. Of this, 11.34 inches, or 74 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of

10, the rainfall in April through September is less than 4.8 inches. Precipitation is lightest in December, January, and February; and heaviest in the last part of May and the first of June.

Winter snowfall is frequent. In all areas, except the higher elevations, the snow cover usually melts during the mild periods that occur at various times during the winter months. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 75 percent of the time in summer and 55 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in the spring.

## How This Survey Was Made

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

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

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the

boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

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

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested

through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. 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 Soil Map Units

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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 or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas 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 or miscellaneous areas can be identified on the map. Likewise, areas that 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 general map units in this survey have been grouped into 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.

The General Soil Map of Niobrara County is a part of the State Soil Geographic (STATSGO) data base and general soils map of Wyoming. Map symbols are the same as the STATSGO general soil map units. In each map unit, two or three of the major soils or miscellaneous land types that occur within each map unit are described. More information for the General Soil Map units can be obtained from the STATSGO database available from the Natural Resources Conservation Service.

## Soils on Flood Plains, Terraces, and Dunes

This group consists of two map units. The soils in this group are nearly level to strongly sloping; very deep; and excessively drained or well drained. The

average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This group is used mainly for rangeland and wildlife habitat.

### 20—Clarkelen-Draknab-Orpha

*Very deep, excessively drained and well drained, nearly level to strongly sloping soils on flood plains, stream terraces and dunes.*

Slope is 0 to 15 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 40 percent Clarkelen and similar soils, 25 percent Draknab and similar soils and 15 percent Orpha and similar soils. The remaining 20 percent is components of minor extent.

Clarkelen and similar soils are on nearly level flood plains and stream terraces. These soils are very deep and well drained. They formed in stratified alluvium derived from various sources. The soils are dominantly medium textured but have thin moderately coarse and moderately fine textured layers.

Draknab and similar soils are on nearly level flood plains and stream terraces. These soils are very deep and excessively drained. They formed in stratified alluvium derived from various sources. The soils are dominantly coarse textured but have thin moderately coarse textured layers.

Orpha and similar soils are on nearly level to strongly sloping dunes. These soils are very deep and excessively drained. They formed in eolian deposits derived from various sources. The soils are coarse textured.

Of minor extent in this unit are Haverdad soils on terraces and flood plains and Dwyer soils on terraces and dunes.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation.

These units provide winter and year-round habitat for pronghorn antelope, and mule deer. Also included in this unit are habitats for species such as; water shrew, muskrat, beaver, raccoon, mink, white tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert and Nutall's cottontail rabbit, coyote, red fox, and birds common to shrub steppes, fields, wetland shrubs, and trees and those associated with water.

### **203—Haverdad-Clarkelen-Draknab**

*Very deep, excessively drained and well drained, nearly level to gently sloping soils on flood plains and stream terraces.*

Slope is 0 to 4 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 40 percent Haverdad and similar soils, 30 percent Clarkelen and similar soils and 15 percent Draknab and similar soils. The remaining 15 percent is components of minor extent.

Haverdad and similar soils are on nearly level to gently sloping flood plains and stream terraces. These soils are very deep and well drained. They formed in stratified alluvium derived from various sources. The soils are dominantly medium textured but have thin moderately coarse and moderately fine textured layers.

Clarkelen and similar soils are on nearly level flood plains and stream terraces. These soils are very deep and well drained. They formed in stratified alluvium derived from various sources. The soils are dominantly moderately coarse textured but have thin coarse and medium textured layers.

Draknab and similar soils are on nearly level flood plains and stream terraces. These soils are very deep and excessively drained. They formed in stratified alluvium derived from various sources. The soils are dominantly coarse textured but have thin moderately coarse textured layers.

Of minor extent in this unit are Kishona soils on adjacent alluvial fans and Orpha soils on associated dunes.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation.

These units provide winter and year-round habitat for pronghorn antelope and mule deer. Also included

in this unit are habitats for species such as; water shrew, muskrat, beaver, raccoon, mink, white tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert and Nutall's cottontail rabbit, coyote, red fox, and birds common to shrub steppes, fields, wetland shrubs, and trees and those associated with water.

### **Soils on the Hat Creek Breaks**

This group consists of one map unit. The soils in this group are moderately sloping to very steep; shallow to very deep; somewhat excessively drained and well drained. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This group is used for rangeland and wildlife habitat.

### **17—Ustic Torriorthents-Torriorthentic Haplustolls-Rock outcrop**

*Shallow to very deep, somewhat excessively drained and well drained, moderately sloping to very steep soils and rock outcrop on ridges and hillsides.*

Slope is 6 to 60 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Ustic Torriorthents and similar soils, 25 percent Torriorthentic Haplustolls and similar soils, and 20 percent Rock outcrop. The remaining 25 percent is components of minor extent.

Ustic Torriorthents and similar soils are on moderately sloping to very steep ridges and hillsides. These soils are shallow to very deep and well drained or somewhat excessively drained. They formed in alluvium and residuum derived from sandstone. The soils are moderately coarse or medium textured.

Torriorthentic Haplustolls and similar soils are on moderately sloping to very steep ridges and hillsides. These soils are shallow to very deep and well drained or somewhat excessively drained. They formed in alluvium and eolian deposits derived from sandstone. The soils are moderately coarse or medium textured.

Rock outcrop consists of exposed areas of sandstone.

Of minor extent in this unit are moderately deep and deep coarse textured soils on valley sideslopes and footslopes.



**Figure 2.** An area of the Ustic Torriorthents-Torriorthentic Haplustolls-Rock outcrop associated with the Hat Creek Breaks.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by droughtiness of the soils. Steepness of slope in many areas limits access by livestock (fig. 2).

This unit provides winter and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; red squirrel, porcupine, coyote, red fox, and birds common to shrub steppes and conifer forests.

## Soils on Uplands

This group consists of sixteen map units. The soils in this group are nearly level to very steep; shallow to very deep; and somewhat excessively drained, excessively drained, and well drained. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

The soils in this group are used mainly for rangeland and wildlife habitat. A few areas are used for crops.

## 11—Bahl-Orella-Cadoma

*Shallow, moderately deep, and very deep, well drained, nearly level to steep soils on alluvial fans, terraces, hillslopes, and dissected plains.*

Slope is 0 to 25 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 40 percent Bahl and similar soils, 20 percent Orella and similar soils, and 15 percent Cadoma soils. The remaining 25 percent is components on minor extent.

Bahl and similar soils are on nearly level to moderately sloping alluvial fans, terraces, and

footslopes of hills. These soils are very deep and well drained. They formed in alluvium derived from shale. The soils have a moderately fine textured surface layer and a fine textured underlying material.

Orella and similar soils are on gently sloping to steep dissected plains. These soils are shallow and well drained. They formed in residuum from sodic shale. The soils have a moderately fine textured surface layer and a fine textured underlying material. These soils are slightly saline and moderately alkaline to very strongly alkaline.

Cadoma and similar soils are on gently sloping to moderately steep hillslopes and dissected plains. These soils are moderately deep and well drained. They formed in alluvium derived from sodic shale. The soils have a moderately fine textured surface layer and upper subsoil and a fine textured lower subsoil and substratum. These soils are slightly saline and strongly alkaline to very strongly alkaline.

Of minor extent in this unit are Savageton and Shingle soils on hillslopes and dissected plains.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation, the salinity and alkalinity of the Orella and Cadoma soils, and the droughtiness of the Orella soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 13—Orpha-Dwyer

*Very deep, excessively drained, nearly level to strongly sloping soils on footslopes of hills, valley sideslopes, and dunes.*

Slope is 0 to 15 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is 40 percent Orpha and similar soils, and 35 percent Dwyer and similar soils. The remaining 25 percent is components of minor extent.

Orpha and similar soils are on nearly level to strongly sloping footslopes of hills, valley sideslopes, and dunes. These soils are very deep and excessively

drained. They formed in eolian deposits derived from various sources. The soils are coarse textured.

Dwyer and similar soils are on nearly level to strongly sloping valley sideslopes and footslopes of hills. These soils are very deep and excessively drained. They formed in eolian deposits derived from various sources. The soils are coarse textured.

Of minor extent in this unit are Keeline and Vonalee soils on terraces and footslopes of hills and Taluce soils on valley sideslopes.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation and the droughtiness of the soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 14—Bahl-Petrie-Grummit

*Shallow and very deep, well drained, nearly level to very steep soils on alluvial fans, terraces, hills, ridges, and dipslopes.*

Slope is 0 to 45 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Bahl and similar soils, 25 percent Petrie and similar soils, and 20 percent Grummit and similar soils. The remaining 20 percent is components of minor extent.

Bahl and similar soils are on nearly level to moderately sloping alluvial fans, terraces, and footslopes of hills. These soils are very deep and well drained. They formed in alluvium derived from shale. The soils have a moderately fine textured surface layer and a fine textured underlying material.

Petrie and similar soils are on nearly level alluvial fans and terraces. These soils are very deep and well drained. They formed in alluvium derived from various sources. The soils are fine textured. These soils are slightly saline and strongly alkaline or very strongly alkaline.

Grummit and similar soils are on moderately sloping to very steep hills, ridges, and dipslopes.

These soils are shallow and well drained. They formed in residuum derived from acidic shale. The soils are fine textured and are strongly acid or very strongly acid.

Of minor extent in this unit are Ulm and Kishona soils on alluvial fans.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation, the salinity and alkalinity of the Petrie soils, and the droughtiness of the Grummit soils.

This unit provides winter and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; red squirrel, porcupine, coyote, red fox, and birds common to shrub steppes and conifer forests.

### 16—Cambria-Senlar-Badland

*Very deep, well drained, nearly level to steep soils and Badland on alluvial fans, terraces, and hillslopes.*

Slope is 0 to 40 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 40 percent Cambria and similar soils, 25 percent Senlar and similar soils, and 10 percent Badland. The remaining 25 percent is components of minor extent.

Cambria and similar soils are on nearly level to strongly sloping terraces, alluvial fans, and footslopes of hills. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. The soils have a medium textured surface layer, a moderately fine textured subsoil, and a moderately coarse textured substratum.

Senlar and similar soils are on nearly level terraces and alluvial fans. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. The soils are medium textured.

Badland consists of eroded areas on moderately sloping to steep hillslopes where siltstone and shale bedrock is at or near the surface. These areas are barren of vegetation.

Of minor extent in this unit are Forkwood and Kishona soils on alluvial fans and toeslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 18—Jayem-Manter-Busher

*Deep and very deep, well drained, nearly level to strongly sloping soils on alluvial fans, terraces, valley sideslopes, and shoulder slopes and footslopes of hills.*

Slope is 0 to 15 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Jayem and similar soils, 30 percent Manter and similar soils, and 15 percent Busher and similar soils. The remaining 25 percent is components of minor extent.

Jayem and similar soils are on nearly level to strongly sloping alluvial fans, footslopes of hills, and valley sideslopes. These soils are very deep and well drained. They formed in alluvium and eolian deposits derived from sandstone. The soils are moderately coarse textured.

Manter and similar soils are on nearly level to moderately sloping alluvial fans, terraces, and footslopes of hills. These soils are very deep and well drained. They formed in eolian deposits derived from sedimentary rocks. The soils are moderately coarse textured.

Busher and similar soils are on nearly level to gently sloping valley sideslopes and shoulder slopes of hills. These soils are deep and well drained. They formed in eolian deposits and residuum derived from sandstone. The soils are coarse textured.

Of minor extent in this unit are Vetal and Alice soils on alluvial fans and Phiferson soils on footslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Some areas are used for cropland. The soils in this unit have few properties that limit production of vegetation suitable for livestock grazing. If this unit is used for small grain or hay crops, the main limitation is the severe hazard of wind erosion.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also

included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, prairies and small-grain fields.

### 19—Tassel-Rock outcrop-Jayem

*Shallow and very deep, somewhat excessively drained and well drained, nearly level to very steep soils and rock outcrop on ridges, alluvial fans, valley sideslopes, and hills.*

Slope is 0 to 70 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Tassel and similar soils, 30 percent Rock outcrop, and 15 percent Jayem and similar soils. The remaining 20 percent is components of minor extent.

Tassel and similar soils are on gently sloping to very steep ridges, valley sideslopes, and hillslopes. These soils are shallow and somewhat excessively drained. They formed in residuum derived from sandstone. The soils are coarse textured.

Rock outcrop consists of areas of exposed sandstone.

Jayem and similar soils are on nearly level to strongly sloping alluvial fans, hills, and valley sideslopes. These soils are very deep and well drained. They formed in eolian deposits derived from sandstone. The soils are moderately coarse textured throughout.

Of minor extent in this unit are Vetal soils on alluvial fans and Phiferson soils on valley sideslopes and footslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the percentage of rock outcrop and the droughtiness of the Tassel soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 21—Dailey-Jayem-Tassel

*Shallow and very deep, somewhat excessively drained and well drained, nearly level to very steep*

*soils on dunes, alluvial fans, hillslopes, valley sideslopes, and ridges.*

Slope is 0 to 70 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Dailey and similar soils, 30 percent Jayem and similar soils, and 15 percent Tassel and similar soils. The remaining 20 percent is components of minor extent.

Dailey and similar soils are on nearly level to moderately sloping dunes. These soils are very deep and well drained. They formed in eolian deposits derived from sandstone. The soils are coarse textured.

Jayem and similar soils are on nearly level to strongly sloping alluvial fans, footslopes of hills, and valley sideslopes. These soils are very deep and well drained. They formed in eolian deposits derived from sandstone. The soils are moderately coarse textured.

Tassel and similar soils are on gently sloping to very steep ridges and hillslopes. These soils are shallow and somewhat excessively drained. They formed in residuum derived from sandstone. The soils are coarse textured.

Of minor extent in this unit are Orpha soils on dunes and Phiferson soils on valley sideslopes.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the droughtiness of the Tassel and Dailey soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 27—Epping-Senlar-Rock outcrop

*Shallow and very deep, well drained, nearly level to very steep soils and rock outcrop on alluvial fans, fan terraces, and hillslopes.*

Slope is 0 to 50 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Epping and similar soils, 20 percent Senlar and similar soils, and 20

percent Rock outcrop. The remaining 25 percent is components of minor extent.

Epping and similar soils are on gently sloping to very steep hillslopes that have been dissected by numerous drainageways and fan terraces. These soils are shallow and well drained. They formed in residuum derived from siltstone. The soils are medium textured.

Senlar and similar soils are on nearly level alluvial fans. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. The soils are medium textured.

Rock outcrop consists of areas of exposed siltstone, shale, and fine-grained sandstone.

Of minor extent in this unit are Skilak soils on alluvial fans and Kadoka soils on footslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation and the droughtiness of the Epping soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 53—Kishona-Forkwood-Theedle

*Moderately deep and very deep, well drained, nearly level to steep soils on alluvial fans, terraces, hillslopes, dissected drainageways, and ridges.*

Slope is 0 to 30 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Kishona and similar soils, 25 percent Forkwood and similar soils, and 20 percent Theedle and similar soils. The remaining 25 percent is components of minor extent.

Kishona and similar soils are on nearly level to steep alluvial fans, hillslopes, and in dissected drainageways. These soils are very deep and well drained. They formed in alluvium derived from various sources. The soils have a medium textured surface layer, a moderately fine textured subsoil, and a medium textured substratum.

Forkwood and similar soils are on nearly level to strongly sloping footslopes of hills, alluvial fans, and terraces. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rocks. The soils have a medium textured surface layer,

a moderately fine textured upper subsoil, and a medium textured lower subsoil.

Theedle and similar soils are on nearly level to steep terraces, ridges, and hillslopes and in drainageways. These soils are moderately deep and well drained. They formed in residuum and alluvium derived from various sources. The soils are medium textured throughout.

Of minor extent in this unit are Cambria soils on alluvial fans and footslopes of hills and Shingle soils on ridges.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### 116—Lithic Haplustolls-Rock outcrop

*Shallow, well drained, moderately sloping to very steep soils and rock outcrop on hills and ridges.*

Slope is 6 to 60 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is 55 percent Lithic Haplustolls and similar soils and 20 percent Rock outcrop. The remaining 25 percent is components of minor extent.

Lithic Haplustolls and similar soils are on moderately sloping to very steep hills and ridges. These soils are shallow and well drained. They formed in residuum derived from limestone, igneous, and metamorphic rocks. The soils are moderately coarse or medium textured and are very gravelly.

Rock outcrop consists of areas of exposed limestone and various igneous and metamorphic rock.

Of minor extent in this unit are moderately deep soils on valley sideslopes, ridges, and footslopes of hills.

This unit is used mainly for wildlife habitat. Some areas are used for rangeland. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation, and the droughtiness of the soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also

included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

### 118—Vetal-Noden-Trelona

*Shallow and very deep, somewhat excessively drained and well drained, nearly level to steep soils on alluvial fans, terraces, hillslopes, and ridges.*

Slope is 0 to 30 percent. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Vetal and similar soils, 25 percent Noden and similar soils, and 20 percent Trelona and similar soils. The remaining 25 percent is components of minor extent.

Vetal and similar soils are on nearly level to moderately sloping alluvial fans and hillslopes. These soils are very deep and well drained. They formed in eolian deposits derived from sandstone. The soils are moderately coarse textured.

Noden and similar soils are on nearly level to gently sloping alluvial fans and terraces. These soils are very deep and well drained. They formed in alluvium and eolian deposits derived from sandstone. The soils have a moderately coarse textured surface layer, a moderately fine and medium textured upper subsoil, and a moderately coarse textured lower subsoil and substratum.

Trelona and similar soils are on gently sloping to moderately steep ridges and hillslopes. These soils are shallow and somewhat excessively drained. The soils have a moderately coarse textured surface layer and a coarse textured underlying material.

Of minor extent in this unit are Jayem and Hargreave soils on alluvial fans and footslopes of hills, and Lambman soils on ridges.

This unit is used mainly for rangeland and wildlife habitat. Some areas of Vetal and Noden soils are used for small grain and hay crops.

The Vetal and Noden soils have few properties that limit the production of vegetation suitable for livestock grazing. Production of vegetation on the Trelona soils suitable for livestock grazing is mainly limited by the droughtiness. If the Vetal and Noden soils are used for small grain and hay crops, the main limitation is the severe hazard of wind erosion.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also

included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger, and birds common to shrub steppes, grasslands, prairies and small grain fields.

### 209—Ulm-Forkwood-Shingle

*Shallow and very deep, well drained, nearly level to very steep soils on alluvial fans, terraces, and hillslopes.*

Slope is 0 to 45 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Ulm and similar soils, 30 percent Forkwood and similar soils, and 10 percent Shingle and similar soils. The remaining 25 percent is components of minor extent.

Ulm and similar soils are on nearly level to gently sloping alluvial fans. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. The soils have a medium textured surface layer and a moderately fine and fine textured subsoil.

Forkwood and similar soils are on nearly level to strongly sloping footslopes of hills, alluvial fans, and terraces. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rocks. The soils have a medium textured surface layer, a moderately fine textured upper subsoil, and a medium textured lower subsoil.

Shingle and similar soils are on gently sloping to very steep hillslopes. These soils are shallow and well drained. They formed in residuum derived from shale. The soils have a medium textured surface layer and underlying material. Weakly consolidated shale bedrock is at a depth of 10 to 20 inches.

Of minor extent in this unit are Theedle and Kishona soils on footslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation. Production of vegetation is also limited by the droughtiness of the Shingle soil.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote,

red fox, badger and birds common to shrub steppes, grasslands, and prairies.

### **211—Shingle-Samday-Rock outcrop**

*Shallow, well drained, gently sloping to very steep soils and rock outcrop on ridges and hills.*

Slope is 3 to 45 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Shingle and similar soils, 30 percent Samday and similar soils, and 15 percent Rock outcrop. The remaining 25 percent is components of minor extent.

Shingle and similar soils are on gently sloping to very steep ridges and hills. These soils are shallow and well drained. They formed in residuum derived from shale. The soils are medium textured.

Samday and similar soils are on gently sloping to steep ridges and hillslopes. These soils are shallow and well drained. They formed in residuum derived from shale. The soils are fine textured.

Rock outcrop consists of areas of exposed shale and some interbedded sandstone.

Of minor extent in this unit are Hilight and Taluce soils on ridges and shoulders slopes of hills, and Theedle and Savaeton soils on footslopes of hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation and the droughtiness of the soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

### **354—Minnequa-Manzanola-Pierre**

*Moderately deep and very deep, well drained, nearly level to steep soils on alluvial fans, terraces, tablelands, and hills.*

Slope is 0 to 25 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Minnequa and similar soils, 25 percent Manzanola and similar soils, and 20

percent Pierre and similar soils. The remaining 25 percent is components of minor extent.

Minnequa and similar soils are on nearly level to steep hills and tablelands. These soils are moderately deep and well drained. They formed in residuum derived from limestone. The soils are moderately fine textured.

Manzanola and similar soils are on nearly level to gently sloping alluvial fans and terraces. These soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. The soils are moderately fine textured.

Pierre and similar soils are on gently sloping to moderately steep hills. These soils are moderately deep and well drained. They formed in residuum derived from shale. The soils are fine textured.

Of minor extent in this unit are Ulm soils on terraces and Shingle and Midway soils on hills.

This unit is used mainly for rangeland and wildlife habitat. Production of vegetation suitable for livestock grazing is mainly limited by the low annual precipitation.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

### **388—Jayem-Turnercrest-Taluce**

*Shallow, moderately deep, and very deep, well drained, nearly level to very steep soils on hills.*

Slope is 0 to 50 percent. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F., and the average frost-free period is 110 to 130 days.

This unit is about 30 percent Jayem and similar soils, 25 percent Turnercrest and similar soils, and 20 percent Taluce and similar soils.

Jayem and similar soils are on nearly level to strongly sloping hills. These soils are very deep and well drained. They formed in alluvium and eolian deposits derived from sandstone. These soils are moderately coarse textured.

Turnercrest and similar soils are on nearly level to moderately steep hills. These soils are moderately deep and well drained. They formed in residuum derived from sandstone. These soils are moderately coarse textured soils. Depth to sandstone bedrock ranges from 20 to 40 inches.

Taluca and similar soils are on gently sloping to very steep hills. These soils are shallow and well drained. They formed in residuum derived from sandstone. These soils are moderately coarse textured. Depth to sandstone bedrock ranges from 10 to 20 inches.

Most areas are used as rangeland and wildlife habitat but a few areas are used as nonirrigated cropland.

Most areas of this unit are well suited for production of vegetation for livestock grazing. Production of vegetation is mainly limited by the low annual precipitation. Livestock grazing on the Taluca soil is also limited by the low vegetation production and the steepness of slope.

Nonirrigated cropland is suitable only on the nearly level to moderately sloping areas of the Jayem and similar soils. The hazard of wind erosion and the low annual precipitation are the main concerns on these soils.

This unit provides winter, summer, and year-round habitat for pronghorn antelope and mule deer. Also included in this unit are habitats for species such as; white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail rabbit, coyote, red fox, badger, and birds common to shrub steppes, grasslands, prairies and small grain fields.

## Detailed Soil Map Units

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

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

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

where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, 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 layers. 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, Clarkelen fine sandy loam, saline is one of several phases in the Clarkelen series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Forkwood-Cambria-Cushman loams, 6 to 15 percent slopes is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Keeline-Kishona association, 0 to 6 percent slopes is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example.

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 or miscellaneous areas.

### **100—Absted-Arvada complex, 0 to 3 percent slopes**

This map unit is on alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 40 percent Absted fine sandy loam and 40 percent Arvada very 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 Ulm loam and Petrie clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Absted soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is pale brown fine sandy loam 2 inches thick. The upper part of the subsoil is light brownish gray silty clay loam 9 inches thick. The lower part is slightly saline, strongly alkaline, light gray silty clay loam 10 inches thick. The substratum is slightly saline, strongly alkaline, light gray silty clay to a depth of 60 inches or more.

Permeability of the Absted 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 severe.

The Arvada soil is very deep and well drained. It formed in alluvium derived from sodic shale. Typically, the surface layer is light brownish gray very fine sandy loam 2 inches thick. The upper part of the subsoil is strongly alkaline, pale brown silty clay loam 14 inches thick. The next part is slightly saline, strongly alkaline, brown silty clay 8 inches thick. The lower part, to a depth of 60 inches or more, is slightly saline, strongly alkaline, pale brown silty clay loam.

Permeability of the Arvada soil is very slow. 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Absted soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and Sandberg bluegrass increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

The potential plant community on the Arvada soil is mainly inland saltgrass, Sandberg bluegrass, western wheatgrass, greasewood, gardner saltbush, and alkali sacaton. As the range condition deteriorates, greasewood and gardner saltbush increase. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 650 pounds in favorable years to 250 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by salinity and alkalinity of the soils and low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds. The Absted soil is well suited for mechanical range renovation and range seeding. The Arvada soil is poorly suited for mechanical range renovation and range seeding. The main limitation is the salinity and alkalinity of the soil. If range seedings are conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity and alkalinity of the Arvada soil. The low annual

precipitation should also be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass VIs, nonirrigated. The Absted soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Arvada soil is in the Saline Upland, 10- to 14-inch precipitation, Northern Plains range site. These soils are in windbreak suitability group 9C.

### **101—Absted-Cambria loams, 0 to 3 percent slopes**

This map unit is on alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Absted loam and 30 percent Cambria 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 Arvada silty clay loam, Ulm clay loam, Forkwood loam, and Slickspots. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Absted soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is light brownish gray loam 5 inches thick. The upper part of the subsoil is light yellowish brown silty clay loam 5 inches thick. The lower part is light yellowish brown silty clay loam 9 inches thick. The substratum, to a depth of 60 inches or more, is light yellowish brown clay loam. This soil is strongly alkaline and slightly saline in the lower part of the subsoil and in the substratum.

Permeability of the Absted 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 moderate.

The Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray loam 3 inches thick. The upper part of the subsoil is light yellowish brown clay loam 10 inches thick. The lower part is pale brown clay loam 10 inches thick. The

substratum, to a depth of 60 inches or more, is light yellowish brown loam.

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

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Absted soil is well suited for stockwater ponds. The Cambria soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. This unit is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

The Absted soil is in capability subclass VIs, nonirrigated. The Cambria soil is in capability subclass IVe, nonirrigated. This map unit is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Absted soil is in windbreak suitability group 9C. The Cambria soil is in windbreak suitability group 8.

### **102—Albinas-Recluse loams, 0 to 6 percent slopes**

This map unit is on alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 40 percent Albinas loam and 40 percent Recluse 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 Coaliams loam on lower slopes and Cedak loam on upper slopes. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Albinas soil is very deep and well drained. It formed in alluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark grayish brown loam 10 inches thick. The upper part of the subsoil is dark brown and grayish brown clay loam 24 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray loam.

Permeability of the 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.

The Recluse soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown loam 7 inches thick. The upper part of the subsoil is brown and dark brown clay loam 17 inches thick. The lower part is brown and pale brown loam 13 inches thick. The substratum, to a depth of 60 inches or more, is light gray loam.

Permeability of the Recluse 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 rangeland and cropland. It is also used for wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. To

reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. This unit is in windbreak suitability group 3.

### **103—Alice-Manter fine sandy loams, 0 to 6 percent slopes**

This map unit is on alluvial fans and terraces. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 55 percent Alice fine sandy loam and 25 percent Manter 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 map unit are small areas of Jayem fine sandy loam, Phiferson fine sandy loam, and Bayard fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Alice soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is brown fine sandy loam 9 inches thick. The upper part of the subsoil is pale brown fine sandy loam 10 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sandy loam.

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

The Manter soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is brown fine sandy loam 9 inches thick. The upper 9 inches of the subsoil is brown fine sandy loam. The lower part is pale brown sandy loam 10 inches thick. The substratum, to a depth of 60 inches or more, is light gray fine sandy loam.

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

This unit is used mainly for cropland. It is also used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, threadleaf sedge, blue grama, and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces runoff, water erosion, and wind erosion. Stripcropping also helps to control wind erosion (fig. 3.) Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion and the available water capacity of the soils. Maintaining crop residue on or near the surface reduces runoff and erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. This unit is in windbreak suitability group 3.

### **104—Alice-Phiferson fine sandy loams, 3 to 10 percent slopes**

This map unit is on terraces and hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 55 percent Alice fine sandy loam and 30 percent Phiferson 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 Manter fine sandy loam on lower slopes and Jayem fine sandy loam on upper slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Alice soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sedimentary rock. Typically, the surface layer is grayish brown fine sandy loam 13 inches thick. The upper part of the subsoil is light brownish gray fine sandy loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light gray fine sandy loam.

Permeability of the 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 severe.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 8 inches thick. The upper part of the subsoil is brown fine sandy loam 15 inches thick. The lower part is light brownish gray fine sandy loam 7 inches thick. Weakly consolidated sandstone is at a depth of 30 inches.



Figure 3. An area of detailed map unit 103 - Alice-Manter fine sandy loams, 0 to 6 percent slopes, in wheat strips in the background. In the foreground on the valley sideslopes dissected by numerous drainageways is detailed map unit 182 - Rock outcrop-Tassel complex, 6 to 70 percent slopes.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used mainly for rangeland and cropland. It is also used for wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, threadleaf sedge, blue grama, and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the

desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and water erosion and the droughtiness of the soils. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces runoff and water and wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are steepness of slope, the hazards of wind erosion and water erosion, and the available water capacity of the soils. Because of the steepness of slope, sprinkler irrigation is the best method. Maintaining crop residue on or near the surface reduces runoff and erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Alice soil is in windbreak suitability group 8. The Phiferson soil is in windbreak suitability group 6D.

### **105—Badland**

This map unit consists of moderately sloping to steep areas on gullied hillslopes where siltstone or shale bedrock is at or near the surface. The areas are 25 to 250 acres in size.

This map unit is used for wildlife habitat. These areas are barren of vegetation. A few grasses and forbs grow in the drainages and on the small alluvial fans.

This map unit is in capability class VIII.

### **106—Bahl clay, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and stream terraces. It formed in alluvium derived from shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Ulm clay loam and Savageton clay.

Typically, the surface layer is light gray clay 5 inches thick. The underlying material, to a depth of 60 inches or more, is light gray clay.

Permeability is slow. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and birdfoot sagebrush. As the range condition deteriorates,

sagebrush increases. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. This soil is well suited for stockwater ponds. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the clayey surface layer. The low annual precipitation should also be considered when reseeding.

This map unit is in capability subclass IVs, nonirrigated. It is in the Dense Clay, 10- to 14-inch precipitation, Northern Plains range site. The Bahl soil is in windbreak suitability group 4CK.

### **107—Bahl-Petrie complex, 0 to 3 percent slopes**

This map unit is on terraces and alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Bahl clay and 35 percent Petrie silty clay. 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 Ulm clay loam and Kishona clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Bahl soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is light gray clay 5 inches thick. The underlying material, to a depth of 60 inches or more, is light gray clay.

Permeability of the Bahl 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 moderate.

The Petrie soil is very deep and well drained. It formed in alluvium derived from various sources.

Typically, the surface layer is strongly alkaline, light brownish gray silty clay 3 inches thick. The underlying material, to a depth of 60 inches, is strongly alkaline, slightly saline, light brownish gray and light gray silty clay.

Permeability of the Petrie soil is very slow. 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Bahl soil is mainly western wheatgrass, green needlegrass, and birdfoot sagebrush. As the range condition deteriorates, sagebrush increases. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

The potential plant community on the Petrie soil is mainly inland saltgrass, alkali sacaton, western wheatgrass, squirreltail, and gardner saltbush. As the range condition deteriorates, inland saltgrass and greasewood increase. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 650 pounds in favorable years to 250 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the salinity and alkalinity of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds. The Bahl soil is moderately well suited for mechanical range renovation and range seeding. The main limitation is the clayey surface layer. The Petrie soil is poorly suited for mechanical range renovation and range seeding. The main limitations are the alkalinity and salinity of the soil. The low annual precipitation should also be considered when reseeding.

The Bahl soil is in capability subclass IVs, nonirrigated. The Petrie soil is in capability subclass VI, nonirrigated. The Bahl soil is in the Dense Clay, 10- to 14-inch precipitation, Northern Plains range site. The Petrie soil is in the Saline Upland, 10- to 14-

inch precipitation, Northern Plains range site. The Bahl soil is in windbreak suitability group 4CK. The Petrie soil is in windbreak suitability group 10.

### **108—Bayard fine sandy loam, 0 to 3 percent slopes**

This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from sandstone. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,200 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Vetal fine sandy loam and Keeline fine sandy loam.

Typically, the surface layer is dark grayish brown fine sandy loam 8 inches thick. The underlying material, to a depth of 60 inches or more, is light brownish gray and pale brown fine sandy loam.

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

This unit is used for cropland, rangeland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, and prairie sandreed. As the range condition deteriorates, threadleaf sedge, blue grama, and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soil. Tillage should be kept to a

minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion and the droughtiness of the soil. Maintaining crop residue on or near the surface reduces wind erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Bayard soil is in windbreak suitability group 8.

### **109—Bidman-Slickspots complex, 0 to 3 percent slopes**

This map unit is on alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Bidman loam and 25 percent Slickspots. 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 Ulm loam and Absted fine sandy loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Bidman soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is pale brown clay 8 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray clay loam.

Permeability of the Bidman 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 moderate.

Slickspots are areas where the surface layer of the soil has been eroded away and the very strongly saline and alkaline subsoil is exposed. These areas support few, if any, plants.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Bidman soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds. The Bidman soil is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding.

To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The Slickspots are poorly suited for mechanical range renovation and range seeding because of the salinity and alkalinity of these areas. The Slickspots are not capable of supporting vegetation.

The Bidman soil is in capability subclass IVe, nonirrigated. The Slickspots are in capability subclass VII, nonirrigated. The Bidman soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Bidman soil is in windbreak suitability group 4C. The Slickspots are in windbreak suitability group 10.

### **110—Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes**

This map unit is on pediment breaks and hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 35 percent Brownrigg very cobbly loam on slopes of 10 to 40 percent, 25 percent Featherlegs loam on slopes of 10 to 20 percent, and 25 percent Wolf loam on slopes of 10 to 20 percent. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of Lambman loam and sandstone rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Brownrigg soil is shallow and well drained. It formed in colluvium derived from various sources. Typically, the surface layer is dark grayish brown very cobbly loam 3 inches thick. The upper part of the subsoil is dark brown very gravelly clay loam 5 inches thick. The lower part is brown very gravelly loam 7 inches thick. Weakly consolidated sandstone is at a depth of 15 inches.

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

The Featherlegs soil is very deep and well drained. It formed in colluvium and alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 5 inches thick. The subsoil is brown and light brownish gray clay loam 18 inches thick. The next part is light brownish gray loam 15 inches thick. The lower part, to depth of 60 inches or more, is light brownish gray very gravelly sandy loam.

Permeability of the Featherlegs soil is moderately slow in the upper part of the subsoil, and very rapid in the lower part. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Wolf soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 4 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 14 inches thick. The next part is light gray clay loam 19 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray extremely gravelly sandy loam. This Wolf soil is outside the characteristics defined for the Wolf series because the upper part of the subsoil extends to a depth below 10 inches and the extremely gravelly layer is above a depth of 40 inches. This, however, does not significantly affect the use and management of the soil.

Permeability of the Wolf soil is moderate in the upper part of the subsoil and very rapid in the lower part. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Brownrigg soil is mainly bluebunch wheatgrass, little bluestem,

blue grama, western wheatgrass, needleandthread, and occasional ponderosa pine and juniper. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 1,100 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

The potential plant community on the Featherlegs and Wolf soils is western wheatgrass, blue grama, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitation is steepness of slope.

The Brownrigg soil is in capability subclass VIIe, nonirrigated. The Featherlegs and Wolf soils are in capability subclass VIe, nonirrigated. The Brownrigg soil is in the Shallow Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Featherlegs and Wolf soils are in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Brownrigg soil is in windbreak suitability group 10. The Featherlegs and Wolf soils are in windbreak suitability group 6.

### **111—Bumbob-Rhoame clays, 0 to 6 percent slopes**

This map unit is on alluvial fans and fan aprons. The native vegetation is mainly mid grasses and occasional shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Bumbob clay and 30 percent Rhoame clay. 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 Bahl clay and clayey soils that have bedrock at a depth of 20 to 40 inches. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Bumbob soil is very deep and well drained. It formed in alluvium derived from acidic shale. Typically, the surface layer is pale brown clay 3 inches thick. The subsoil is pale brown clay 16 inches thick. The upper part of the substratum is pale brown clay 17 inches thick. The lower part, to a depth of 60 inches or more, is light yellowish brown clay.

Permeability of the Bumbob soil is very slow. 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 Rhoame soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown clay 2 inches thick. The upper part of the underlying material is light brownish gray clay 29 inches thick. The lower part, to a depth of 60 inches or more, is yellowish brown clay.

Permeability of the Rhoame soil is slow. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the clayey surface layers. The low annual precipitation should also be considered when reseeding.

This map unit is in capability subclass IVs, nonirrigated. It is in the Clayey, 10- to 14-inch

precipitation, Northern Plains range site. The Bumbob and Rhoame soils are in windbreak suitability group 4C.

### **112—Busher-Phiferson loamy very fine sands, 0 to 6 percent slopes**

This map unit is on valley sideslopes and hillslopes. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Busher loamy very fine sand and 35 percent Phiferson loamy very fine sand. 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 Jayem fine sandy loam and Trelona fine sandy loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Busher soil is deep and well drained. It formed in residuum and eolian deposits derived from sandstone. Typically, the surface layer is brown loamy very fine sand 5 inches thick. The subsoil is brown loamy very fine sand 10 inches thick. The substratum is pale brown loamy very fine sand 39 inches thick. Weakly consolidated sandstone is at a depth of 54 inches. This Busher soil is outside the characteristics defined for the Busher series because it does not contain calcium carbonate in any part of the soil. This difference, however, does not significantly affect the use and management of the soil.

Permeability of the Busher soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown and brown loamy very fine sand 10 inches thick. The upper part of the subsoil is yellowish brown loamy very fine sand 6 inches thick. The lower part is pale brown loamy very fine sand 7 inches thick. Weakly consolidated sandstone is at a depth of 23 inches. This Phiferson soil is outside the characteristics defined for the Phiferson series because it does not contain calcium carbonate in any part of the soil. Also, the subsoil contains more very fine sand. These differences, however, do not significantly affect the use and management of the soil.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is very low. 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, thickspike wheatgrass, Indian ricegrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is poorly suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass VIe, nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Busher soil is in windbreak suitability group 5. The Phiferson soil is in windbreak suitability group 6D.

### **113—Cadoma silty clay loam, 2 to 10 percent slopes**

This moderately deep and well drained soil is on hillslopes. It formed in alluvium derived from sodic shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Orella clay loam and Petrie clay loam.

Typically, the surface layer is light gray silty clay loam 3 inches thick. The subsoil is grayish brown silty clay loam 8 inches thick. The substratum is light brownish gray clay 17 inches thick. Weakly consolidated shale is at a depth of 28 inches. The

subsoil and substratum are slightly saline and strongly alkaline.

Permeability is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, inland saltgrass, Sandberg bluegrass, alkali sacaton, greasewood, and gardner saltbush. As the range condition deteriorates, greasewood and gardner saltbush increase. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 650 pounds in favorable years to 250 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the salinity and alkalinity of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the depth to bedrock. It is poorly suited for mechanical range renovation and range seeding. The main limitations are the salinity and alkalinity of the soil.

This map unit is in capability subclass VIc nonirrigated. It is in the Saline Upland, 10- to 14-inch precipitation, Northern Plains range site. The Cadoma soil is in windbreak suitability group 9C.

### **114—Cedak-Trelona complex, 6 to 20 percent slopes**

This map unit is on dissected tablelands. The native vegetation is mainly grasses and shrubs. Elevation is 4,600 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 50 percent Cedak loam on slopes of 6 to 10 percent and 40 percent Trelona fine sandy loam on slopes of 6 to 20 percent. The components of this unit are so intricately intermingled that it was not possible to map them at the scale used.

Included in this unit are small areas of Hargreave sandy loam, Recluse loam, Tassel fine sandy loam, and sandstone rock outcrop. Included areas make up about 10 percent of the total acreage. The percent varies from one area to another.

The Cedak soil is moderately deep and well drained. It formed in alluvium derived from various sources. Typically the surface layer is dark grayish brown loam 8 inches thick. The upper part of the subsoil is brown clay loam 11 inches thick. The lower part is pale brown very fine sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 32 inches.

Permeability of the Cedak soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Trelona soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically the surface layer is grayish brown fine sandy loam about 10 inches thick. The underlying material, to a depth of 19 inches, is pale brown loamy very fine sand. Weakly consolidated sandstone is at a depth of 19 inches.

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

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Cedak soil is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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 potential plant community on the Trelona soil is mainly little bluestem, needleandthread, Indian ricegrass, and western wheatgrass. As the range condition deteriorates, threadleaf sedge and blue grama increases. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitation is the steepness of slope. The

depth to bedrock also limits the development of stockwater ponds.

The Cedak soil is in capability subclass IVe, nonirrigated. The Trelona soil is in capability subclass VIIe, nonirrigated. The Cedak soil is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Trelona soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Cedak soil is in windbreak suitability group 6D. The Trelona soil is in windbreak suitability group 10.

### **115—Clarkelen fine sandy loam, overflow, 0 to 3 percent slopes**

This very deep, well drained soil is on flood plains. It formed in alluvium derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Draknab sand and Haverdad loam.

Typically, the upper part of the surface layer is grayish brown fine sandy loam 6 inches thick. The upper 14 inches of the underlying material is light brownish gray weakly stratified fine sandy loam and loamy fine sand. The next 10 inches is light brownish gray highly stratified loam and very fine sandy loam. The lower part, to a depth of 60 inches or more, is stratified grayish brown and light brownish gray fine sandy loam and fine sand.

Permeability is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly green needlegrass, basin wildrye, and western wheatgrass. As the range condition deteriorates, needleandthread and wild roses increase. The potential plant community produces about 1,800 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,200 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the

desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should also be considered when reseeding.

This map unit is in capability subclass IVe, nonirrigated. It is in the Overflow, 10- to 14-inch precipitation, Northern Plains range site. The Clarkelen soil is in windbreak suitability group 5K.

### **116—Clarkelen-Draknab-Dwyer complex, 0 to 6 percent slopes**

This map unit is on flood plains and stream terraces. The native vegetation is mainly grasses, shrubs, and cottonwood trees. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Clarkelen fine sandy loam on stream terraces and flood plains with slopes of 0 to 3 percent, 20 percent Draknab fine sandy loam on stream terraces and flood plains with slopes of 0 to 3 percent, and 20 percent Dwyer fine sand, on dunes on the stream terraces, with slopes of 0 to 6 percent. 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 Haverdad loam and Orpha fine sand. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Clarkelen soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light olive gray fine sandy loam 3 inches thick. The underlying material, to a depth of 60 inches or more, is light yellowish brown stratified very fine sandy loam, fine sandy loam, loam, and loamy sand.

Permeability of the Clarkelen soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding.

The Draknab soil is very deep and excessively drained. It formed in alluvium derived from various sources. Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The upper 15 inches of the underlying material is pale brown stratified coarse sand and coarse sandy loam. The lower part, to a depth of 60 inches or more, is light gray coarse sand stratified with thin layers of sandy loam.

Permeability of the Draknab soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding.

The Dwyer soil is very deep and excessively drained. It formed in eolian deposits derived from various sources. Typically, the surface layer is light brownish gray fine sand 5 inches thick. The upper part of the underlying material is pale brown loamy fine sand 19 inches thick. The lower part, to a depth of 60 inches, is very pale brown loamy fine sand.

Permeability of the Dwyer soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Clarkelen and Draknab soil is mainly green needlegrass, basin wildrye, slender wheatgrass, and western wheatgrass. As the range condition deteriorates, needleandthread and wild roses increase. The potential plant community produces about 3,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,300 pounds in favorable years to 1,600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

The potential plant community on the Dwyer soil is mainly prairie sandreed, sand bluestem, and needleandthread. As the range condition deteriorates, Sandberg bluegrass and silver sagebrush increase. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,700 pounds in favorable years to 900 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The Clarkelen and Draknab soils are moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The Dwyer soil is poorly suited for mechanical range renovation and range seeding due to the hazard of wind erosion. Tillage for range improvement on the Dwyer soil is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation on the Dwyer soil may not be economically feasible due to the coarse texture of the surface layer.

The Clarkelen and the Draknab soils are in capability subclass IVe, nonirrigated. The Dwyer soil is in capability subclass VIe, nonirrigated. The Clarkelen and Draknab soils are in the Lowland, 10- to 14-inch precipitation, Northern Plains range site. The Dwyer soil is in the Sands, 10- to 14-inch precipitation, Northern Plains range site. The Clarkelen and Draknab soils are in windbreak suitability group 5K. The Dwyer soil is in windbreak suitability group 7.

### **117—Coaliams loam, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Recluse loam and Vetal fine sandy loam.

Typically, the surface layer is dark gray loam 7 inches thick. The upper part of the underlying material is stratified gray loam, clay loam, and sandy clay loam 12 inches thick. The lower part, to a depth of 60 inches or more, is stratified pale brown loam, clay loam, and sandy clay loam.

Permeability 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. This soil is subject to a rare hazard of flooding.

This unit is used for cropland, rangeland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

The map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Coaliams soil is in windbreak suitability group 8.

### **118—Cushman-Forkwood loams, 0 to 6 percent slopes**

This map unit is on alluvial fans and terraces. The native vegetation is mainly short and mid grasses, forbs and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Cushman loam and 35 percent Forkwood loam. The components of the 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 Bowbac sandy loam and Hiland sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Cushman soil is moderately deep and well drained. It formed in alluvium and residuum derived from sedimentary rock. Typically, the surface layer is brown loam 4 inches thick. The upper part of the subsoil is brown loam 4 inches thick. The next part is pale brown clay loam 16 inches thick. The lower part is very pale brown loam 13 inches thick. Weakly consolidated, gray, platy shale is at a depth of 37 inches.

Permeability of the Cushman 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 moderate. The hazard of wind erosion is moderate.

The Forkwood soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 4 inches thick. The upper part of the subsoil is brown loam 5 inches thick. The next part is pale brown clay loam 6 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown loam.

Permeability of the Forkwood 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, blue grama, green needlegrass, and needleandthread. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Cushman soil is poorly suited for stockwater ponds due to the depth to bedrock. The Forkwood soil is moderately well suited for stockwater ponds with the

moderate potential for seepage losses being the main limitation. This unit is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Cushman soil is in windbreak suitability group 6D. The Forkwood soil is in windbreak suitability group 3.

### **119—Dailey-Orpha, moist, loamy sands, 0 to 6 percent slopes**

This map unit is on dunes. The native vegetation is mainly mid and tall grasses, forbs and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Dailey loamy sand and 30 percent Orpha loamy sand. 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 Manter fine sandy loam and Tullock loamy fine sand. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Dailey soil is very deep and well drained. It formed in eolian deposits derived from sandstone. Typically, the surface layer is grayish brown and brown loamy sand 14 inches thick. The upper part of the underlying material is light yellowish brown loamy sand 17 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sand.

Permeability of the Dailey soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Orpha, moist soil is very deep and excessively drained. It formed in eolian deposits derived from sandstone. Typically, the surface layer is grayish brown loamy sand 4 inches thick. The upper part of the underlying material is pale brown loamy fine sand 15 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sand.

Permeability of the Orpha, moist soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the

hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly prairie sandreed, needleandthread, sand bluestem, sand sagebrush, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soils.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is poorly suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass VIe, nonirrigated. It is in the Sands, 15- to 17-inch precipitation, Southern Plains range site. The Dailey and Orpha, moist soils are in windbreak suitability group 7.

### **120—Draknab loamy fine sand, 0 to 3 percent slopes**

This very deep, excessively drained soil is on flood plains. It formed in alluvium derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Haverdad loam.

Typically, the surface layer is brown loamy fine sand 5 inches thick. The upper part of the underlying material is pale brown stratified loamy sand and fine sandy loam 24 inches thick. The lower part, to a depth of 60 inches or more, is pale brown stratified coarse sand, loamy fine sand, and fine sandy loam.

Permeability 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 severe. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly green needlegrass, basin wildrye, slender wheatgrass, needleandthread, and western wheatgrass. As the range condition deteriorates, needleandthread and wild roses increase. The potential plant community produces about 2,300 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is poorly suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Lowland, 10- to 14-inch precipitation, Northern Plains range site. The Draknab soil is in windbreak suitability group 5K.

### **121—Endoaquolls-Torrifluvents complex, 0 to 3 percent slopes**

This map unit is on stream bottoms and subirrigated flood plains. The native vegetation is mainly short and mid grasses. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Endoaquolls soils and 40 percent Torrifluvents soils. 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 Coaliums loam. Included areas make up 20 percent of the total

acreage. The percentage varies from one area to another.

The Endoaquolls soil is very deep and poorly drained. It formed in alluvium derived from mixed sources. No single profile of these soils is typical as these soils are highly variable within short distances. Commonly, the surface layer is dark grayish brown fine sandy loam or loamy sand 10 to 20 inches thick. The underlying material, to a depth of 60 inches or more, is commonly dark greenish gray and is highly stratified. Layers of loamy sand, fine sandy loam, loam, or clay loam of variable thickness are most common.

Permeability of the Endoaquolls soil is moderate or moderately rapid. Available water capacity is high. Effective rooting depth for most plants is 12 to 36 inches, but it is 60 inches or more for plants that can tolerate a high water table. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is slight. This soil is subject to occasional brief flooding in March through August. A water table is at a depth of 1 to 3 feet from March to June.

The Torrfluvents soil is very deep and somewhat poorly drained. It formed in alluvium derived from mixed sources. No single profile of these soils is typical as these soils are highly variable within short distances. Commonly the surface layer is grayish brown or pale brown loam, sandy loam, or loamy sand 4 to 6 inches thick. The underlying material, to a depth of 60 inches, is pale brown to light gray and is highly stratified. Layers of loamy sand, fine sandy loam, or loam of variable thickness are most common.

Permeability of the Torrfluvents soil is moderate or moderately rapid. Available water capacity is high. Effective rooting depth for most plants is 24 to 48 inches, but it is 60 inches or more for plants that can tolerate a water table. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to occasional brief flooding in March through August. A water table is at a depth of 2 to 4 feet from March to June.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Endoaquolls soil is mainly prairie cordgrass, Nebraska sedge, bluejoint reedgrass, and Baltic rush. As the range condition deteriorates, rushes and willows increase. The potential plant community produces about 5,500 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 4,000 pounds in unfavorable years. Production of vegetation on this soil suitable for livestock grazing is limited by wetness.

The potential plant community on the Torrfluvents soil is mainly big bluestem, Indiangrass, little bluestem, prairie cordgrass, and western wheatgrass. As the range condition deteriorates, western wheatgrass, sedges, and rushes increase. The potential plant community produces about 5,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,500 pounds in favorable years to 3,500 pounds in unfavorable years.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds. Pits dug below the depth of the water table in the soils can be developed as sources for stockwater. The unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is wetness in the spring and early summer which limits the use of equipment on this unit during this period.

This map unit is in capability subclass Vw, nonirrigated. The Endoaquolls soil is in the Wetland, 15- to 17-inch precipitation, Southern Plains range site. The Torrfluvents soil is in the Subirrigated, 15- to 17-inch precipitation, Southern Plains range site. The Endoaquolls soils are in windbreak suitability group 2K. The Torrfluvents soils are in windbreak suitability group 1K.

## **122—Epping-Badland complex, 3 to 50 percent slopes**

This map unit is on hillslopes and fan terraces that are dissected by numerous drainageways. The native vegetation is mainly short and mid grasses, forbs and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Epping silt loam and 35 percent Badland. 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 Senlar silt loam, Kadoka silt loam, and Skilak silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Epping soil is shallow and well drained. It formed in residuum derived from siltstone. Typically, the surface layer is light brownish gray silt loam 4

inches thick. The underlying material is light gray and very pale brown silt loam 9 inches thick. Weakly consolidated siltstone is at a depth of 13 inches.

Permeability of the Epping soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Badland consist of areas where siltstone bedrock is at or near the surface. These areas are dissected by numerous drainageways. These areas are barren of vegetation.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Epping soil is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 450 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and droughtiness of the soil.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Epping soil is in capability subclass VIIe, nonirrigated. The Badland is in capability class VIII, nonirrigated. The Epping soil is in the Shallow Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Epping soil and Badland are in windbreak suitability group 10.

### **123—Featherlegs-Wolf loams, 0 to 6 percent slopes**

This map unit is on stream terraces. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 50 percent Featherlegs loam on slopes of 0 to 3 percent and 40 percent Wolf loam on slopes of 3 to 6 percent. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of Brownrigg very cobbly loam and Lambman loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Featherlegs soil is very deep and well drained. It formed in colluvium and alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 5 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 18 inches thick. The next part is light brownish gray loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray very gravelly sandy loam.

Permeability of the Featherlegs soil is moderately slow in the upper part of the subsoil and very rapid in the lower part. 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 Wolf soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam about 4 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 14 inches thick. The next part is light gray clay loam 14 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray extremely gravelly sandy loam. This Wolf soil is outside the characteristics defined for the Wolf series because the upper part of the subsoil extends to a depth below 10 inches and the extremely gravelly layer is above a depth of 40 inches. This, however, does not significantly affect the use and management of the soil.

Permeability of the Wolf soil is moderate in the upper part of the subsoil and very rapid in the lower part. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, blue grama, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is well suited for mechanical range renovation and range seeding. To reduce the hazard of wind erosion during reseeding,

adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IIIe, nonirrigated. It is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. These soils are in windbreak suitability group 6.

### **124—Featherlegs-Wolf loams, 6 to 10 percent slopes**

This map unit is in swales and on hillcrests. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 55 percent Wolf loam and 30 percent Featherlegs loam. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of Brownrigg very cobbly loam and Lambman loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Featherlegs soil is very deep and well drained. It formed in colluvium and alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 5 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 18 inches thick. The next part is light brownish gray loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray very gravelly sandy loam.

Permeability of the Featherlegs soil is moderately slow in the upper part of the subsoil and very rapid in the lower part. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Wolf soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 4 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 14 inches thick. The next part is light gray clay loam 14 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray extremely gravelly sandy loam. This Wolf soil is outside the characteristics defined for the Wolf series because the upper part of the subsoil extends to a depth below 10 inches and the extremely gravelly layer is above a depth of 40 inches. This,

however, does not significantly affect the use and management of the soil.

Permeability of the Wolf soil is moderate in the upper part of the subsoil and very rapid in the lower part. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, blue grama, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should also be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The soils are in windbreak suitability group 6.

### **125—Featherlegs-Wolf-Brownrigg complex, 3 to 10 percent slopes**

This map unit is on crests and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 35 percent Featherlegs loam on slopes of 3 to 6 percent, 30 percent Wolf loam on slopes of 3 to 6 percent, and 25 percent Brownrigg very cobbly loam on slopes of 6 to 10 percent. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of Lambman loam and very deep, very gravelly soils. Included

areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Featherlegs soil is very deep and well drained. It formed in colluvium and alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 5 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 18 inches thick. The next part is light brownish gray loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray very gravelly sandy loam.

Permeability of the Featherlegs soil is moderately slow in the upper part of the subsoil and very rapid in the lower part. 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 Wolf soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 4 inches thick. The upper part of the subsoil is brown and light brownish gray clay loam 14 inches thick. The next part is light gray clay loam about 14 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray extremely gravelly sandy loam. This Wolf soil is outside the characteristics defined for the Wolf series because the upper part of the subsoil extends to a depth below 10 inches and the extremely gravelly layer is above a depth of 40 inches. This, however, does not significantly affect the use and management of the soil.

Permeability of the Wolf soil is moderate in the upper part of the subsoil and very rapid in the lower part. 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.

The Brownrigg soil is shallow and well drained. It formed in colluvium derived from various sources. Typically, the surface layer is dark grayish brown very cobbly loam 3 inches thick. The upper part of the subsoil is dark brown very gravelly clay loam 5 inches thick. The lower part is brown very gravelly loam 7 inches thick. Weakly consolidated sandstone is at a depth of 15 inches.

Permeability of the Brownrigg soil is moderately slow. 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 unit is used for rangeland and wildlife habitat.

The potential plant community on the Featherlegs and Wolf soils is western wheatgrass, blue grama, and needleandthread. As the range condition deteriorates,

blue grama and threadleaf sedge increase. 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 potential plant community on the Brownrigg soil is mainly bluebunch wheatgrass, little bluestem, blue grama, western wheatgrass, needleandthread, and occasional ponderosa pine and juniper. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 1,100 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Brownrigg soil also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The rock fragments in the surface layer of the Brownrigg soil also limit range renovation and range seeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should also be along the contour of the slope.

The Featherlegs and Wolf soils are in capability subclass IIIe, nonirrigated. The Brownrigg soil is in capability subclass VIIe, nonirrigated. The Featherlegs and Wolf soils are in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Brownrigg soil is in the Shallow Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Featherlegs and Wolf soils are in windbreak suitability group 6. The Brownrigg soil is in windbreak suitability group 10.

## **126—Forkwood-Cambria loams, 0 to 6 percent slopes**

This map unit is on footslopes of hills, alluvial fans, and terraces. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The

average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Forkwood loam and 40 percent Cambria 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 Cushman loam and Theedle loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Forkwood soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 5 inches thick. The upper part of the subsoil is brown clay loam 7 inches thick. The next part is light brownish gray clay loam 8 inches thick. The lower part, to a depth of 60 inches, is light brownish gray loam.

Permeability of the Forkwood 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 3 inches thick. The upper part of the subsoil is brown clay loam 6 inches thick. The lower part is pale brown loam 5 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown fine sandy loam.

Permeability of the Cambria 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Forkwood soil is in windbreak suitability group 3. The Cambria soil is in windbreak suitability group 8.

### **127—Forkwood-Cambria-Cushman loams, 6 to 15 percent slopes**

This map unit is on footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Forkwood loam, 30 percent Cambria loam, and 20 percent Cushman 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 Ulm loam in association with the Forkwood and Cambria soils and Theedle loam in association with the Cushman soil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Forkwood soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is light brownish gray loam 2 inches thick. The upper part of the subsoil is brown and light yellowish brown clay loam 9 inches thick. The next part is very pale brown clay loam 6 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown loam.

Permeability of the Forkwood 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is light brownish gray loam 2 inches thick. The upper part of the subsoil is light

yellowish brown clay loam 8 inches thick. The lower part is very pale brown clay loam 22 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown fine sandy loam.

Permeability of the Cambria 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 Cushman soil is moderately deep and well drained. It formed in residuum and alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 3 inches thick. The upper part of the subsoil is brown and pale brown clay loam 12 inches thick. The lower part is very pale brown loam 15 inches thick. Weakly consolidated shale is at a depth of 30 inches.

Permeability of the Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Forkwood and Cambria soils are moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Cushman soil is poorly suited for stockwater ponds due to the depth to bedrock. This unit is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The

Forkwood soil is in windbreak suitability group 3. The Cambria soil is in windbreak suitability group 8. The Cushman soil is in windbreak suitability group 6D.

### **128—Forkwood-Cushman-Terro complex, 2 to 10 percent slopes**

This map unit is on terraces and alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Forkwood loam, 30 percent Cushman loam, and 20 percent Terro sandy loam. The components of this map 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 Cambria loam near areas of the Forkwood soil, Theedle loam near areas of the Cushman soil, and Keeline sandy loam near areas of the Terro soil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Forkwood soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is light brownish gray loam 4 inches thick. The upper part of the subsoil is brown clay loam 17 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray loam.

Permeability of the Forkwood 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 Cushman soil is moderately deep and well drained. It formed in residuum and alluvium derived from sedimentary rocks. Typically, the surface layer is grayish brown loam 2 inches thick. The upper part of the subsoil is grayish brown clay loam 10 inches thick. The lower part is light grayish brown loam 22 inches thick. Weakly consolidated shale is at a depth of 34 inches.

Permeability of the Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Terro soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is light brownish gray sandy loam 8 inches thick. The upper part of the subsoil is

pale brown sandy loam 16 inches thick. The lower part is light brownish gray sandy loam 12 inches thick. Weakly consolidated sandstone is at a depth of 36 inches.

Permeability of the Terro soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on Forkwood and Cushman soils is mainly needleandthread, western wheatgrass, blue grama and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 potential plant community on the Terro soil is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The production of vegetation on this unit suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Forkwood soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Cushman and Terro soils are poorly suited for stockwater ponds due to the depth to bedrock. The Forkwood and Cushman soils are well suited for mechanical range renovation and range seeding. The Terro soil is moderately well suited for mechanical range renovation and range seeding with the hazard of wind erosion being the main limitation. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. The Forkwood and Cushman soils are in Loamy, 10- to 14-inch precipitation, Northern Plains

range site. The Terro soil is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Forkwood soil is in windbreak suitability group 3. The Cushman and Terro soils are in windbreak suitability group 6D.

### **129—Grummit, cool-Rock outcrop complex, 6 to 40 percent slopes**

This map unit is on ridges and dipslopes. The native vegetation is mainly ponderosa pine, juniper, and grasses. Elevation is 4,000 to 4,400 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 55 percent Grummit clay loam on slopes of 6 to 40 percent and 20 percent Rock outcrop on slopes of 10 to 40 percent. 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 moderately deep and deep clayey soils in draws and swales. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Grummit soil is shallow and well drained. It formed is residuum derived from acidic shale. Typically, the surface layer is light brownish gray clay loam 2 inches thick. The underlying material is brownish gray clay 12 inches thick. Weakly consolidated grayish brown to dark gray acidic shale is at a depth of 14 inches.

Permeability of the Grummit soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed grayish brown to gray, weakly consolidated, acidic shales.

This unit is used for wildlife habitat and rangeland.

The potential plant community on this unit is mainly ponderosa pine and juniper with an understory of Sandberg bluegrass, green needlegrass, blue grama, western wheatgrass, and threadleaf sedge. As the range condition deteriorates, annual forbs increase. The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds. The presence of trees on this unit also makes range seeding and mechanical range renovation impractical.

The Grummit soil is in capability subclass VIle, nonirrigated. The Rock outcrop is in capability class VIII. The Grummit soil is in a Grazeable Woodland site, 10- to 14-inch precipitation, Northern Plains zone. The Grummit soil is in windbreak suitability group 10.

### **130—Grummit, warm-Rock outcrop complex, 6 to 40 percent slopes**

This map unit is on dissected hills. The native vegetation is mainly mid and tall grasses and shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Grummit clay and 30 percent shale rock outcrop. The components in 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 Paiges clay and Hilight clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Grummit soil is shallow and well drained. It formed in residuum derived from acidic shale. Typically, the surface layer is grayish brown clay 3 inches thick. The underlying material is grayish brown clay 13 inches thick. Weakly consolidated acidic shale is at a depth of 16 inches.

Permeability of the Grummit soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed gray to grayish brown, weakly consolidated, acidic shale.

This unit is used for wildlife habitat and rangeland.

The potential plant community on this unit is mainly western wheatgrass, little bluestem, sand bluestem, and threadleaf sedge. As the range condition deteriorates, threadleaf sedge and big sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation and droughtiness of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Grummit soil is in capability subclass VIle, nonirrigated. The Rock outcrop is in capability class VIII. The Grummit soil is in the Shallow Porous Clay, 10- to 14-inch precipitation, Northern Plains range site. The Grummit soil is in windbreak suitability group 10.

### **131—Grummit-Hilight clays, 6 to 15 percent slopes**

This map unit is on hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 40 percent Grummit clay and 35 percent Hilight clay. 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 Savageton clay, Rhoame clay, and Rock outcrop. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Grummit soil is shallow and well drained. It formed in residuum derived from acidic shale. Typically, the surface layer is pale brown clay 3 inches thick. The underlying material is light yellowish brown clay 12 inches thick. Weakly consolidated, gray, acidic shale is at a depth of 15 inches.

Permeability of the Grummit soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Hilight soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay 3 inches thick. The underlying material is light brownish gray clay 16 inches thick. Weakly consolidated gray shale is at a depth of 19 inches.

Permeability of the Hilight soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of

water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, bluebunch wheatgrass, and green needlegrass. As the range condition deteriorates, broom snakeweed and annuals increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soils and the low annual precipitation.

This unit is poorly suited for stockwater ponds due to the depth to bedrock. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the droughtiness of the soils. Mechanical range renovation may not be economically feasible. The low annual precipitation should be considered when reseeding. If range seedings are conducted, plant species should be carefully selected because of the droughtiness of the soil.

This map unit is in capability subclass VIe, nonirrigated. It is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Grummit and Hilight soils are in windbreak suitability group 10.

### **132—Grummit-Hilight-Rock outcrop complex, 15 to 45 percent slopes**

This unit is 35 percent Grummit clay, 30 percent Hilight clay loam, and 15 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 Savageton clay loam and Samday clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Grummit soil is shallow and well drained. It formed in residuum derived from acidic shale. Typically, the surface layer is light brownish gray clay 3 inches thick. The underlying material is light brownish gray clay 11 inches thick. Weakly consolidated, gray, acidic shale is at a depth of 14 inches.

Permeability of the Grummit soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard

of water erosion is severe. The hazard of wind erosion is moderate.

The Hilight soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay loam 4 inches thick. The underlying material is grayish brown clay 12 inches thick. Weakly consolidated, gray, shale is at a depth of 16 inches.

Permeability of the Hilight soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed weakly consolidated shale.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Grummit soil is mainly western wheatgrass, little bluestem, bluebunch wheatgrass, and inland saltgrass. As the range condition deteriorates, broom snakeweed and annuals increase. The potential plant community produces about 400 pounds of air-dry vegetation per acre in normal years. Production varies from 500 pounds in favorable years to 200 pounds in unfavorable years.

The potential plant community on the Hilight soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, sagebrush increases. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation on this unit suitable for livestock grazing is limited by droughtiness of the soils and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Grummit and Hilight soils are in capability subclass VIle, nonirrigated. The Rock outcrop is in capability class VIII. The Grummit soil is in the Shale, 10- to 14-inch precipitation, Northern Plains range site and the Hilight soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Grummit and Hilight soils are in windbreak suitability group 10.

### **133—Hargreave-Cedak fine sandy loams, 2 to 10 percent slopes**

This map unit is on footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Hargreave fine sandy loam and 40 percent Cedak 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 Recluse fine sandy loam and Trelona fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Hargreave soil is moderately deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The upper part of the subsoil is brown loam 4 inches thick. The lower part is yellowish brown and light yellowish brown sandy clay loam 11 inches thick. The substratum is very pale brown fine sandy loam 10 inches thick. Weakly consolidated sandstone is at a depth of 30 inches.

Permeability of the Hargreave soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Cedak soil is moderately deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 8 inches thick. The upper part of the subsoil is brown clay loam 11 inches thick. The lower part is pale brown very fine sandy loam 11 inches thick. Weakly consolidated sandstone is at a depth of 30 inches.

Permeability of the Cedak soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, thickspike wheatgrass, prairie sandreed, and little bluestem. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses and the depth to bedrock. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Hargreave and Cedak soils are in windbreak suitability group 6D.

### **134—Hargreave-Lambman association, 1 to 8 percent slopes**

This map unit is on hills and in adjacent swales. The native vegetation is mainly short and mid grasses, forbs, and low growing shrubs. Elevation is 4,700 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Hargreave fine sandy loam in swales and 30 percent Lambman loam on hills.

Included in this unit are Noden fine sandy loam in swales and depressions, Phiferson fine sandy loam on hills, and Trelona fine sandy loam on hill crests. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Hargreave soil is moderately deep and well drained. It formed in eolian deposits and residuum derived from sandstone. Typically, the surface layer is dark brown fine sandy loam 5 inches thick. The subsoil is brown sandy clay loam 14 inches thick. The substratum is pale brown very fine sandy loam 7 inches thick. Weakly consolidated sandstone is at a depth of 26 inches.

Permeability of the Hargreave soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Lambman soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown loam 4 inches thick. The subsoil is brown clay loam and pale brown loam 13 inches thick. Weakly consolidated, fine-grained sandstone is at a depth of 17 inches.

Permeability of the Lambman soil is moderate. 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 unit is used for rangeland and wildlife habitat.

The potential plant community on the Hargreave soil is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, blue grama and silver sagebrush increase. 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 potential plant community on the Lambman soil is mainly bluebunch wheatgrass, little bluestem, needleandthread, and western wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 1,100 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

Production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the Lambman soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the depth to bedrock. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

The Hargreave soil is in capability subclass IVe, nonirrigated. The Lambman soil is in capability subclass VIe, nonirrigated. The Hargreave soil is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Lambman soil is in the Shallow Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Hargreave soil is in windbreak suitability group 6D. The Lambman soil is in windbreak suitability group 10.

### **135—Hargreave-Noden fine sandy loams, 0 to 6 percent slopes**

This map unit is on terraces. The native vegetation is mainly short and mid grasses, forbs and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Hargreave fine sandy loam and 30 percent Noden 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 Trelona, Taluce, Phiferson, and Moskee fine sandy loams. Included areas make up 20 percent of the total acreage. The percentage varies from one area to another.

The Hargreave soil is moderately deep and well drained. It formed in eolian deposits and residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam 5 inches thick. The upper part of the subsoil is brown sandy clay loam 14 inches thick. The lower part is brown loam 6 inches thick. The substratum is pale brown fine sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 38 inches.

Permeability of the Hargreave 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 severe.

The Noden soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 15 inches thick. The upper part of the subsoil is brown sandy clay loam 6 inches thick. The lower part is pale brown sandy clay loam 15 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown fine sandy loam.

Permeability of the Noden 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 severe.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, blue grama and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Hargreave soil also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces runoff and wind erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

The Hargreave soil is in capability subclass IVe, irrigated and nonirrigated. The Noden soil is in capability subclass IIIe, irrigated and nonirrigated. This map unit is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Hargreave soil is in

windbreak suitability group 6D. The Noden soil is in windbreak suitability group 3.

### **136—Haverdad loam, overflow, 0 to 4 percent slopes**

This very deep, well drained soil is on flood plains and stream terraces. It formed in alluvium derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Clarkelen sandy loam and Kishona loam.

Typically, the surface layer is light brownish gray loam 9 inches thick. The underlying material, to a depth of 60 inches, is light brownish gray loam stratified with lenses of clay loam and fine sandy loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly basin wildrye, green needlegrass, western wheatgrass, and Canby bluegrass. As the range condition deteriorates, blue grama and silver sagebrush increase. The potential plant community produces about 1,800 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,200 pounds in unfavorable years.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Overflow, 10- to 14-inch

precipitation, Northern Plains range site. The Haverdad soil is in windbreak suitability group 8.

### **137—Haverdad-Clarkelen complex, 0 to 3 percent slopes**

This map unit is on flood plains and stream terraces. The native vegetation is mainly grasses, shrubs, and cottonwood trees. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Haverdad loam and 40 percent Clarkelen 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 Kishona loam, Draknab sand, and Coaliams loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Haverdad soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is pale brown loam 4 inches thick. The upper 20 inches of the underlying material is pale brown loam stratified with lenses of sandy loam and clay loam. The lower part, to a depth of 60 inches or more, is pale brown clay loam stratified with thin lenses of loam and silty clay loam.

Permeability of the Haverdad soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to a rare hazard of flooding.

The Clarkelen soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light olive gray fine sandy loam 3 inches thick. The underlying material, to a depth of 60 inches or more, is light yellowish brown sandy loam stratified with lenses of loam and loamy sand.

Permeability of the Clarkelen soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly green needlegrass, basin wildrye, slender wheatgrass, and western wheatgrass. As the range condition

deteriorates, needleandthread and wild roses increase. The potential plant community produces about 2,300 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,600 pounds in unfavorable years.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Haverdad soil is well suited for stockwater ponds. The Clarkelen soil is poorly suited for stockwater ponds due to the potential for seepage losses. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVE, nonirrigated. It is in the Lowland, 10- to 14-inch precipitation, Northern Plains range site. The Haverdad soil is in windbreak suitability group 8. The Clarkelen soil is in windbreak suitability group 5K.

### **138—Haverdad-Clarkelen complex, saline, 0 to 3 percent slopes**

This map unit is on flood plains. The native vegetation is mainly short and mid grasses, shrubs, and scattered cottonwood trees. Elevation is 3,600 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Haverdad loam, saline and 40 percent Clarkelen very fine sandy loam, saline. 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 Kishona loam, Draknab sand, and Coaliams loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Haverdad, saline soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the upper part of the surface layer is light brownish gray loam 5 inches

thick. The lower part is light brownish gray, slightly saline, silty clay loam 4 inches thick. The upper part of the underlying material is light gray, slightly saline, silt loam 19 inches thick. The lower part, to a depth of 60 inches or more, is light gray, slightly saline, silty clay loam.

Permeability of the Haverdad, saline soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to a rare hazard of flooding.

The Clarkelen, saline soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is pale brown very fine sandy loam 2 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown, slightly saline, stratified fine sandy loam and loamy fine sand.

Permeability of the Clarkelen soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, bottlebrush squirreltail, inland saltgrass, alkali sacaton, and greasewood. As the range condition deteriorates, greasewood and blue grama increase. The potential plant community produces about 1,700 pounds of air-dry vegetation per acre in normal years. Production varies from 2,200 pounds in favorable years to 1,400 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity of the soils.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Haverdad soil is well suited for stockwater ponds. The Clarkelen soil is poorly suited for stockwater ponds due to the potential for seepage losses. This unit is poorly suited for mechanical range renovation and range seeding. The main limitation is the salinity of the soils. If range seedings are conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity of the soils.

This map unit is in capability subclass IVs, nonirrigated. It is in the Saline Lowland, 10- to 14-inch

precipitation, Northern Plains range site. These soils are in windbreak suitability group 9L.

### **139—Hiland sandy loam, 0 to 6 percent slopes**

This map unit is on alluvial fans, terraces, and plains. The soil formed in alluvium and eolian deposits derived from sandstone. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Included in this unit are small areas of Forkwood loam, Bowbac fine sandy loam, and Vonalee fine sandy loam.

Typically, the upper part of the surface layer is brown sandy loam 4 inches thick. The lower part is grayish brown sandy loam 5 inches thick. The upper part of the subsoil is brown and pale brown sandy clay loam 19 inches thick. The lower part is very pale brown fine sandy loam 12 inches thick. The substratum, to a depth of 60 inches or more, is light yellowish brown sandy loam.

Permeability is moderate. 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Hiland soil is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must

be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Hiland soil is in windbreak suitability group 5.

### **140—Hiland-Bowbac sandy loams, 0 to 6 percent slopes**

This map unit is on footslopes of hills, alluvial fans, and terraces. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Hiland sandy loam and 35 percent Bowbac 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 Terro sandy loam, Vonalee sandy loam, and Forkwood loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Hiland soil is very deep and well drained. It formed in alluvial and eolian deposits derived from sandstone. Typically, the surface layer is brown and grayish brown sandy loam 9 inches thick. The upper part of the subsoil is brown and pale brown sandy clay loam 19 inches thick. The lower part is very pale brown fine sandy loam 12 inches thick. The substratum, to a depth of 60 inches or more, is light yellowish brown sandy loam.

Permeability of the Hiland soil is moderate. 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 severe.

The Bowbac soil is moderately deep and well drained. It formed in alluvium and residuum derived from sedimentary rocks. Typically, the surface layer is brown sandy loam 3 inches thick. The upper part of the subsoil is yellowish brown and pale brown sandy clay loam 16 inches thick. The lower part is pale brown sandy loam 10 inches thick. The substratum is light yellowish brown sandy loam 6 inches thick. Weakly consolidated sandstone is at a depth of 35 inches.

Permeability of the Bowbac 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and fringed sagewort increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Bowbac soil also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Hiland soil is in windbreak suitability group 5. The Bowbac soil is in windbreak suitability group 6D.

### **141—Hiland-Bowbac association, 6 to 15 percent slopes**

This map unit is on terraces and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 40 percent Hiland fine sandy loam and 35 percent Bowbac 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 Terro sandy loam in association with the Bowbac soil and Vonalee sandy loam in association with the Hiland soil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Hiland soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sedimentary rocks. Typically, the surface layer is brown fine sandy loam 10 inches thick. The upper part of the subsoil is brown and yellowish brown sandy clay loam 11 inches thick. The lower part is very pale brown fine sandy loam 10 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown sandy loam.

Permeability of the Hiland 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 severe.

The Bowbac soil is moderately deep and well drained. It formed in alluvium and residuum derived from sedimentary rock. Typically, the surface layer is grayish brown sandy loam 7 inches thick. The subsoil is pale brown sandy clay loam 11 inches thick. The substratum is very pale brown sandy loam 15 inches thick. Weakly consolidated sandstone is at a depth of 33 inches.

Permeability of the Bowbac soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and fringed sagewort increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth

to bedrock in the Bowbac soil also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitations are the hazards of wind erosion and water erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazards of wind erosion and water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. If practical, tillage should also be along the contour of the slope. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Hiland soil is in windbreak suitability group 5. The Bowbac soil is in windbreak suitability group 6D.

### **142—Hilight-Rock outcrop complex, 6 to 40 percent slopes**

This map unit is on hills. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 70 percent Hilight clay and 15 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 Savageton clay loam, Rhoame clay, and Grummit clay. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Hilight soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is olive gray clay 2 inches thick. The underlying material is olive gray clay 8 inches thick. Weakly consolidated gray shale is at a depth of 10 inches.

Permeability of the Hilight soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed platy, gray to olive gray, weakly consolidated shale.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Hilight soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, broom snakeweed and annuals increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by droughtiness of the soil and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Hilight soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII. The Hilight soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Hilight soil is in windbreak suitability group 10.

### **143—Hilight-Savageton clays, 6 to 15 percent slopes**

This map unit is on hills. The native vegetation is mainly grasses and forbs. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Hilight clay and 40 percent Savageton clay. 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 Bahl silty clay and Rhoame clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Hilight soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay 2 inches thick. The underlying material is light brownish gray clay 17 inches thick. Weakly consolidated, gray shale is at a depth of 19 inches.

Permeability of the Hilight soil is slow. Available water capacity is very low. Effective rooting depth is

10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Savageton soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown clay 4 inches thick. The upper part of the subsoil is grayish brown clay about 10 inches thick. The lower part is grayish brown clay 14 inches thick. Weakly consolidated, grayish brown, platy shale is at a depth of 28 inches.

Permeability of the Savageton soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Hilight soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The potential plant community on the Savageton soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation and the droughtiness of the Hilight soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the depth to bedrock. It is moderately suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The droughtiness of the Hilight soil is also a limitation. The low annual precipitation should be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

The Hilight soil is in capability subclass VIe, nonirrigated. The Savageton soil is in capability

subclass IVe, nonirrigated. The Hilight soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Savageton soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Hilight soil is in windbreak suitability group 10. The Savageton soil is in windbreak suitability group 4CK.

#### **144—Jayem-Julesburg fine sandy loams, 0 to 6 percent slopes**

This map unit is on alluvial fans and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Jayem fine sandy loam and 40 percent Julesburg 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 Vetal fine sandy loam, Alice fine sandy loam, and Phiferson fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Jayem soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 11 inches thick. The subsoil is brown fine sandy loam 14 inches thick. The substratum to a depth of 60 inches or more is pale brown fine sandy loam.

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

The Julesburg soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the upper part of the surface layer is brown fine sandy loam 5 inches thick. The lower part is dark grayish brown fine sandy loam 11 inches thick. The subsoil is yellowish brown fine sandy loam 10 inches thick. The upper part of the substratum is pale brown loamy fine sand 6 inches thick. The lower part, to a depth of 60 inches or more, is pale brown loamy fine sand.

Permeability of the Julesburg soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very

slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for cropland, rangeland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, thickspike wheatgrass, and Indian ricegrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and the droughtiness of the soils. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion and the available water capacity of the soils. Maintaining crop residue on or near the surface reduces wind erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs. Sprinkler irrigation is the best method (fig. 4).

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. This map unit is in windbreak suitability group 3.



Figure 4. Irrigation by pivot sprinklers is the most common method used in the survey area and is the most suitable method for these areas of Jayem-Julesburg fine sandy loams, 0 to 6 percent slopes.

### 145—Jayem-Julesburg fine sandy loams, 6 to 15 percent slopes

This map unit is on valley sideslopes and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Jayem fine sandy loam and 30 percent Julesburg 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 Alice fine sandy loam, Trelona fine sandy loam, and Phiferson fine sandy loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Jayem soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is brown fine sandy loam 11 inches thick. The subsoil is light yellowish brown fine sandy loam 12 inches thick. The substratum, to a depth of 60 inches or more, is pale brown fine sandy loam.

Permeability of the 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 moderate. The hazard of wind erosion is severe.

The Julesburg soil is very deep and well drained. It formed in eolian deposits derived from sandstone. Typically, the surface layer is brown and dark grayish brown fine sandy loam 10 inches thick. The subsoil is grayish brown fine sandy loam 16 inches thick. The substratum, to a depth of 60 inches or more, is pale brown fine sandy loam.

Permeability of the Julesburg 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 moderate. The hazard of wind erosion is severe.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this map unit is mainly needleandthread, little bluestem, prairie sandreed, thickspike wheatgrass, and Indian ricegrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitations are the hazards of wind erosion and water erosion. To reduce the hazards of wind erosion and water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. If practical, tillage should also be along the contour of the slope. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

If this unit is used for nonirrigated cropland, the main limitations are the hazards of wind erosion and water erosion and the droughtiness of the soils. Tillage should be kept to a minimum and should be along the contour of the slope. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazards of wind erosion and water erosion, the steepness of slope, and the available water capacity of the soils. Maintaining crop residue on or near the surface reduces wind erosion. Because of the steepness of slope, sprinkler irrigation is the best method. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation

water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. This map unit is in windbreak suitability group 3.

### **146—Jayem-Phiferson-Trelona fine sandy loams, 3 to 10 percent slopes**

This map unit is on valley sideslopes and hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 30 percent Jayem fine sandy loam, 25 percent Phiferson fine sandy loam, and 25 percent Trelona 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 Vetal fine sandy loam and Manter fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Jayem soil is very deep and well drained. It formed in alluvium and eolian material derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 10 inches thick. The subsoil is brown fine sandy loam 12 inches thick. The substratum, to a depth of 60 inches, is light brownish gray fine sandy loam.

Permeability of the 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 moderate. The hazard of wind erosion is severe.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the upper part of the surface layer is dark grayish brown fine sandy loam 4 inches thick. The lower part is grayish brown very fine sandy loam 7 inches thick. The underlying material is pale brown fine sandy loam 14 inches thick. Weakly consolidated sandstone is at a depth of 25 inches.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Trelona soil is shallow and somewhat excessively drained. It formed in residuum derived

from sandstone. Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The next layer is brown fine sandy loam 5 inches thick. The underlying material is pale brown loamy very fine sand 9 inches thick. Weakly consolidated sandstone is at a depth of 19 inches.

Permeability of the Trelona 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Jayem and Phiferson soils is mainly needleandthread, little bluestem, prairie sandreed, thickspike wheatgrass, and Indian ricegrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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 potential plant community on the Trelona soil is mainly little bluestem, needleandthread, Indian ricegrass, and western wheatgrass. As the range condition deteriorates, threadleaf sedge and blue grama increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Phiferson and Trelona soils also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitations are the hazards of wind erosion and water erosion. To reduce the hazards of wind erosion and water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. If practical, tillage should also be along the contour of the slope. Mechanical range renovation may not be economically feasible due to

the coarse texture of the surface layers of all the soils and the droughtiness of the Trelona soil.

The Jayem and Phiferson soils are in capability subclass IVe, nonirrigated. The Trelona soil is in capability subclass VIe, nonirrigated. The Jayem and Phiferson soils are in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Trelona soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Jayem soil is in windbreak suitability group 3. The Phiferson soil is in windbreak suitability group 6D. The Trelona soil is in windbreak suitability group 10.

### **147—Keeline fine sandy loam, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and toeslopes of hills. It formed in alluvium and eolian deposits derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Vonalee fine sandy loam and Turnercrest fine sandy loam.

Typically, the surface layer is brown fine sandy loam 4 inches thick. The upper part of the underlying material is pale brown sandy loam 26 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sandy loam.

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

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Keeline soil is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Keeline soil is in windbreak suitability group 8.

### **148—Keeline fine sandy loam, 6 to 10 percent slopes**

This very deep, well drained soil is on footslopes of hills. It formed in alluvium and eolian deposits derived from various sources. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Turnercrest fine sandy loam and Taluce fine sandy loam.

Typically, the surface layer is light brownish gray fine sandy loam 2 inches thick. The upper part of the underlying material is pale brown and light brownish gray sandy loam 22 inches thick. The lower part to a depth of 60 inches or more is pale brown sandy loam.

Permeability 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 moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Keeline soil is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Keeline soil is in windbreak suitability group 8.

### **149—Keeline-Kishona association, 0 to 6 percent slopes**

This map unit is on alluvial fans and terraces. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Keeline sandy loam and 35 percent Kishona loam.

Included in this unit are small areas of Theedle loam and Cambria loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Keeline soil is very deep and well drained. It formed in alluvium and eolian deposits derived from various sources. Typically, the surface layer is brown sandy loam 3 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown and very pale brown sandy loam.

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

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is brown loam 5 inches thick. The subsoil and substratum, to a depth of 60

inches or more, is pale brown and very pale brown loam.

Permeability of the Kishona 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 for rangeland and wildlife habitat.

The potential plant community on the Keeline soil is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The potential plant community on the Kishona soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Keeline soil is poorly suited for stockwater ponds due to the potential for seepage losses. The Kishona soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Keeline soil is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The Kishona soil is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation on the Keeline soil may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. The Keeline soil is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Kishona soil is in the Loamy, 10- to 14-inch

precipitation, Northern Plains range site. These soils are in windbreak suitability group 8.

### **150—Keeline-Kishona-Theedle complex, 6 to 30 percent slopes**

This map unit is on terraces and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Keeline fine sandy loam on slopes of 6 to 20 percent, 30 percent Kishona loam on slopes of 6 to 30 percent, and 25 percent Theedle loam on slopes of 6 to 30 percent. 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 Cambria loam and Shingle loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Keeline soil is very deep and well drained. It formed in alluvium and eolian deposits derived from various sources. Typically, the surface layer is grayish brown fine sandy loam 6 inches thick. The upper part of the underlying material is pale brown and light gray fine sandy loam 29 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown sandy loam.

Permeability of the Keeline 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 severe.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is brown loam 3 inches thick. The subsoil and substratum, to a depth of 60 inches, are light brownish gray and light gray loam.

Permeability of the Kishona 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 severe. The hazard of wind erosion is moderate.

The Theedle soil is moderately deep and well drained. It formed in residuum and alluvium derived from various sources. Typically, the surface layer is grayish brown loam 4 inches thick. The underlying material is olive brown and pale yellow loam 26 inches thick. Weakly consolidated shale is at a depth of 30 inches.

Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Keeline soil is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The potential plant community on the Kishona and Theedle soils is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The potential for seepage losses in the Keeline soil and the depth to bedrock in the Theedle soil also limit the development of stockwater ponds.

This map unit is in capability subclass VIe, nonirrigated. The Keeline soil is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Kishona and Theedle soils are in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Keeline soil and Kishona soils are in windbreak suitability group 8. The Theedle soil is in windbreak suitability group 6DK.

### **151—Keyner-Slickspots complex, 0 to 6 percent slopes**

This map unit is on fan terraces and stream terraces. The native vegetation is mainly short and mid grasses and shrubs. Elevation is 3,800 to 4,200 feet.

The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Keyner fine sandy loam and 30 percent Slickspots. 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 Absted fine sandy loam, Arvada fine sandy loam, and Kishona loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Keyner soil is very deep and well drained. It formed in sodic alluvium derived from various sources. Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The upper 10 inches of the subsoil is light brownish gray loam and pale brown clay loam. The next part is light brownish gray clay loam 9 inches thick. The lower part is light gray silty clay loam 18 inches thick. The substratum, to a depth of 60 inches or more, is light gray silt loam. This soil is moderately saline and strongly alkaline in all layers below a depth of 15 inches.

Permeability of the Keyner soil is moderate. Available water capacity is moderate. 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 severe.

Slickspots are areas where the surface layer of the soil has been eroded away and the highly saline and alkaline subsoil is exposed. These areas support few, if any, plants.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Keyner soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Keyner soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Keyner soil is well suited for mechanical range renovation and

range seeding. The Slickspots are poorly suited for mechanical range renovation and range seeding as they are not capable of supporting vegetation. If the Keyner soil is seeded, the low annual precipitation should be considered. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

The Keyner soil is in capability subclass VIs, nonirrigated. The Slickspots are in capability subclass VIIs. The Keyner soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Keyner soil is in windbreak suitability group 9L. The Slickspots are in windbreak suitability group 10.

### **152—Kishona silty clay loam, sodic, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and toeslopes of hills. It formed in alluvium derived from sodic shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Arvada silty clay loam, Bahl silty clay, and Cambria loam.

Typically, the surface layer is light brownish gray silty clay loam 2 inches thick. The subsoil is light yellowish brown silty clay loam 12 inches thick. The substratum, to a depth of 60 inches or more, is strongly alkaline, slightly saline, light yellowish brown silty clay loam.

Permeability is moderately slow. 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly alkali sacaton, western wheatgrass, inland saltgrass, and Sandberg bluegrass. As the range condition deteriorates, greasewood increases. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 650 pounds in favorable years to 250 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity and alkalinity of the soil and the low annual precipitation.

This soil is well suited for stockwater ponds. It is poorly suited for mechanical range renovation and

range seeding. The main limitations are the alkalinity and salinity of the soil. The low annual precipitation should also be considered when reseeding. If range seedings are conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity and alkalinity of the soil. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass VIs, nonirrigated. It is in the Saline Upland, 10- to 14-inch precipitation, Northern Plains range site. The Kishona soil is in windbreak suitability group 10.

### **153—Kishona-Cambria loams, 0 to 6 percent slopes**

This map unit is on alluvial fans, terraces, and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Kishona loam and 40 percent Cambria 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 Forkwood loam and Bahl clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is brown loam 4 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Kishona 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 4 inches thick. The upper part of the subsoil is brown clay loam 6 inches thick. The lower part is light gray clay loam 21 inches thick. The substratum, to a depth of 60 inches or more, is pale brown fine sandy loam.

Permeability of the Cambria 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Kishona and Cambria soils are in windbreak suitability group 8.

### **154—Kishona-Cambria-Theedle loams, 6 to 15 percent slopes**

This map unit is on footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Kishona loam, 25 percent Cambria loam, and 25 percent Theedle 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 Forkwood loam on the lower slopes and Cushman loam on the upper slopes. Included areas make up about 10

percent of the total acreage. The percentage varies from one area to another.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light yellowish brown loam 5 inches thick. The underlying material, to a depth of 60 inches or more, is yellowish brown and pale brown loam.

Permeability of the Kishona 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 5 inches thick. The upper part of the subsoil is brown loam 5 inches thick. The lower part is light brownish gray loam 15 inches thick. The substratum, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Cambria 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 Theedle soil is moderately deep and well drained. It formed in residuum and alluvium derived from various sources. Typically, the surface layer is grayish brown loam 4 inches thick. The underlying material is olive brown and pale yellow loam 26 inches thick. Weakly consolidated shale is at a depth of 30 inches.

Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Kishona and Cambria soils are moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Theedle soil is poorly suited for stockwater ponds due to the potential for seepage losses. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The low annual precipitation should be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Kishona and Cambria soils are in windbreak suitability group 8. The Theedle soil is in windbreak suitability group 6DK.

### **155—Las Animas fine sandy loam, 0 to 2 percent slopes**

This very deep and somewhat poorly drained soil is on flood plains. It formed in alluvium derived from sedimentary rock. The native vegetation is mainly short and mid grasses. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Coaliams, Draknab, and very poorly drained soils.

Typically, the surface layer is light brownish gray fine sandy loam 8 inches thick. The underlying material, to a depth of 60 inches or more, is light gray very fine sandy loam stratified with layers of loamy very fine sand and loam.

Permeability is moderately rapid. Available water capacity is high. Effective rooting depth for most plants is 18 to 36 inches, but it is 60 inches or more for plants that can tolerate a water table. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to a rare hazard of flooding. The water table is at a depth of 18 to 36 inches from March to June.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly big bluestem, indiangrass, little bluestem, and western wheatgrass. As the range condition deteriorates, western wheatgrass, sedges, and willows increase. The potential plant community produces about 4,500 pounds of air-dry vegetation per acre in normal years.

Production varies from 5,000 pounds in favorable years to 3,500 pounds in unfavorable years.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is wetness in the spring and early summer which limits the use of equipment during this period. The hazard of wind erosion is also a concern in range seeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IIIw, nonirrigated. It is in the Subirrigated, 15- to 17-inch precipitation, Southern Plains range site. The Las Animas soil is in windbreak suitability group 2KW.

### **156—Lithic Haplustolls-Rock outcrop complex, 6 to 60 percent slopes**

This map unit is on hills and ridges. The native vegetation is mainly grasses and shrubs. Elevation is 5,200 to 6,100 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Lithic Haplustolls soils and 35 percent Rock outcrop. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of shallow soils with a pale brown surface layer and moderately deep soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lithic Haplustolls soil is shallow and well drained. It formed in residuum derived from limestone. No single profile of these soils is typical, but commonly the surface layer is brown loam or gravelly loam 3 to 7 inches thick. The underlying material is commonly brown gravelly or very gravelly loam or clay loam 7 to 17 inches thick. Depth to limestone bedrock is 10 to 20 inches.

Permeability of the Lithic Haplustolls is moderate or moderately rapid. Available water capacity is very low or low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of ledges of exposed limestone.

This unit is used mainly for wildlife habitat. Some areas are used for rangeland.

The potential plant community on this unit is mainly bluebunch wheatgrass, little bluestem, western wheatgrass, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 1,100 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil. Steepness of slope limits access by livestock.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope and the depth to bedrock.

The Lithic Haplustolls soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII, nonirrigated. The Lithic Haplustolls soil is in the Shallow Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Lithic Haplustolls soil is in windbreak suitability group 10.

### **157—Lithic Haplustolls, moist-Rock outcrop complex, 6 to 60 percent slopes**

This map unit is on hills and ridges. The native vegetation is mainly grasses, shrubs, and ponderosa pine. Elevation is 5,200 to 6,100 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Lithic Haplustolls soils and 35 percent Rock outcrop. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of shallow soils with a pale brown surface layer and moderately deep

soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lithic Haplustolls soil is shallow and well drained. It formed in residuum derived from igneous and metamorphic rock. No single profile of these soils is typical, but commonly the surface layer is dark brown very gravelly sandy clay loam or very gravelly sandy loam 6 inches thick. The underlying material is brown very gravelly sandy clay loam or very gravelly sandy loam 4 to 14 inches thick. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Lithic Haplustolls soil is moderate. Available water capacity is very low or low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of ledges of exposed igneous and metamorphic rock. Some areas of limestone rock are intermingled with the igneous and metamorphic rock.

This unit is used mainly for wildlife habitat. Some areas are used for rangeland.

The potential plant community on this unit is mainly ponderosa pine with an understory of little bluestem, bluebunch wheatgrass, needleandthread, and western wheatgrass. Production of vegetation suitable for livestock grazing is limited by the droughtiness of the soils and the tree canopy cover. Steepness of slope limits access by livestock.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope and the depth to bedrock.

The Lithic Haplustolls soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII, nonirrigated. The Lithic Haplustolls soil is in the Grazeable Woodland site, 15- to 17-inch precipitation, Southern Plains zone. The Lithic Haplustolls soil is in windbreak suitability group 10.

### **158—Lohmiller silty clay, 0 to 3 percent slopes**

This very deep, well drained soil is on flood plains and low terraces. It formed in alluvium derived from

shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Haverdad loam and Clarkelen sandy loam.

Typically, the surface layer is grayish brown silty clay 4 inches thick. The upper part of the underlying material is pale brown silty clay 5 inches thick. The lower part, to a depth of 60 inches or more, is pale brown clay loam stratified with layers of loam and silty clay loam.

Permeability 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 moderate. This soil is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly basin wildrye, green needlegrass, and western wheatgrass. As the range condition deteriorates, blue grama and woody plants increase. The potential plant community produces about 1,800 pounds of air-dry vegetation per acre in normal years. Production varies from 2,200 pounds in favorable years to 1,200 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This unit is in capability subclass IVe, nonirrigated. It is in the Clayey Overflow, 10- to 14-inch precipitation, Northern Plains range site. The Lohmiller soil is in windbreak suitability group 4CK.

### **159—Lohmiller-Haverdad complex, saline, 1 to 4 percent slopes**

This map unit is on flood plains and low terraces. The native vegetation is mainly grasses and shrubs.

Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Lohmiller clay loam and 40 percent Haverdad loam. The components of this map 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 saline Clarkelen sandy loam and Kishona loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lohmiller soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is grayish brown clay loam 6 inches thick. The underlying material, to a depth of 60 inches or more, is slightly saline, grayish brown clay loam stratified with thin lenses of loam and clay.

Permeability of the Lohmiller 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 moderate. It is subject to a rare hazard of flooding.

The Haverdad soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is light brownish gray loam 9 inches thick. The underlying material, to a depth of 60 inches or more, is slightly saline, light brownish gray loam stratified with lenses of silty clay loam and fine sandy loam.

Permeability of the Haverdad soil is moderate. 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. It is subject to a rare hazard of flooding.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, bottlebrush squirreltail, inland saltgrass, alkali sacaton, and greasewood. As the range condition deteriorates, greasewood and blue grama increase. The potential plant community produces about 1,700 pounds of air-dry vegetation per acre in normal years. Production varies from 2,200 pounds in favorable years to 1,400 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the salinity of the soil and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is poorly suited for mechanical range renovation and range seeding. The main limitation is the salinity of the soils. The low annual precipitation should also be considered when reseeding. If range seedings are conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity of the soils. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is capability subclass IVs, nonirrigated. It is in the Saline Lowland, 10- to 14-inch precipitation, Northern Plains range site. The Lohmiller soil is in windbreak suitability group 9C. The Haverdad soil is in windbreak suitability group 9L.

### **160—Manzanola silty clay loam, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from sedimentary rocks. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Pierre clay and Ulm loam.

Typically, the surface layer is light brownish gray silty clay loam 4 inches thick. The upper part of the subsoil is grayish brown and light gray silty clay loam 11 inches thick. The lower part of the subsoil, to a depth of 60 inches or more, is light gray silty clay loam.

Permeability is slow. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,100 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Manzanola soil is in windbreak suitability group 4CK.

### **161—Minnequa silt loam, 2 to 6 percent slopes**

This moderately deep, well drained soil is on tablelands. It formed in residuum derived from limestone. The native vegetation is mainly grasses and shrubs. The average annual precipitation is 10 to 14 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Midway and Pierre soils.

Typically, the surface layer is grayish brown silt loam 4 inches thick. The underlying material is light grayish brown and pale brown silty clay loam 20 inches thick. Weakly consolidated, light gray limestone is at a depth of 24 inches.

Permeability is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used mainly for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing

is limited by droughtiness of the soil and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the depth to bedrock. It is well suited for mechanical range renovation and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Minnequa soil is in windbreak suitability group 6DK.

### **162—Minnequa-Midway silty clay loams, 6 to 25 percent slopes**

This map unit is on hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

The unit is 50 percent Minnequa silty clay loam and 40 percent Midway silty clay loam. The components of this unit are so intricately intermingled that it is not practical to map them at the scale used.

Included in this unit are small areas of Pierre and Shingle soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Minnequa soil is moderately deep and well drained. It formed in residuum derived from limestone. Typically, the surface layer is grayish brown silty clay loam 4 inches thick. The underlying material is light grayish brown and pale brown silty clay loam 20 inches thick. Weakly consolidated, light gray limestone is at a depth of 24 inches.

Permeability of the Minnequa soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Midway soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is pale olive silty clay loam 4 inches thick. The underlying material is light yellowish brown and olive silty clay loam 12 inches thick. Weakly consolidated shale is at a depth of 16 inches.

Permeability of the Midway soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The unit is used for rangeland and wildlife habitat.

The potential plant community on the Minnequa soil is mainly western wheatgrass, needleandthread, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. 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 potential plant community on the Midway soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the Midway soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the steepness of slope and depth to bedrock. It is poorly suited for mechanical range renovation and range seeding due to the steepness of slope and the hazard of water erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used.

This map unit is in capability subclass VIe, nonirrigated. The Minnequa soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Midway soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Minnequa soil is in windbreak suitability group 6DK. The Midway soil is in windbreak suitability group 10.

### **163—Moskee fine sandy loam, 0 to 3 percent slopes**

This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium and eolian deposits derived from sedimentary rocks. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Alice fine sandy loam, Recluse loam, and Manter fine sandy loam.

Typically, the surface layer is grayish brown fine sandy loam 8 inches thick. The upper part of the subsoil is brown sandy clay loam 16 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown fine sandy loam.

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

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Moskee soil is in windbreak suitability group 3.

### **164—Moskee-Manter fine sandy loams, 3 to 10 percent slopes**

This map unit is on footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Moskee fine sandy loam and 40 percent Manter 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 Alice fine sandy loam, Jayem fine sandy loam, Recluse loam, and Vetal fine sandy loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Moskee soil is very deep and well drained. It formed in eolian deposits and alluvium derived from sedimentary rocks. Typically, the surface layer is dark brown fine sandy loam 10 inches thick. The upper part of the subsoil is brown sandy clay loam 21 inches thick. The lower part, to a depth of 60 inches or more, is grayish brown and light brownish gray sandy loam.

Permeability of the Moskee 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 severe.

The Manter soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is dark grayish brown fine sandy loam 21 inches thick. The substratum, to a depth of 60 inches, is light brownish gray fine sandy loam.

Permeability of the Manter 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 moderate. The hazard of wind erosion is severe.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitations are the hazards of wind erosion and water erosion. To reduce the hazards of wind erosion and water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. If practical, tillage should also be along the contour of the slope. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and the hazard of water erosion. The droughtiness of the Manter soil is also a limitation. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces runoff, water erosion, and wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazards of wind erosion and water

erosion and steepness of slope. The droughtiness of the Manter soil is also a limitation. Maintaining crop residue on or near the surface reduces runoff, water erosion, and wind erosion. Because of the steepness of slope, sprinkler irrigation is the best method. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Moskee and Manter soils are in windbreak suitability group 3.

### **165—Moskee-Manter complex, dry, 0 to 6 percent slopes**

This map unit is on alluvial fans and terraces. The native vegetation is mainly mid grasses, forbs, and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 40 percent Moskee fine sandy loam and 40 percent Manter 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 Hiland fine sandy loam and Vonalee fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Moskee soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sedimentary rocks. Typically, the surface layer is grayish brown fine sandy loam 10 inches thick. The upper part of the subsoil is brown sandy clay loam 10 inches thick. The next part is pale brown sandy clay loam 7 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown sandy loam.

Permeability of the Moskee 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 severe.

The Manter soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sedimentary rocks. Typically, the surface layer is brown and grayish brown sandy loam 11 inches thick. The upper part of the subsoil is yellowish brown sandy loam 23 inches thick. The lower part is pale brown sandy loam 15 inches thick. The substratum, to a depth of 60 inches or more, is light brownish gray sandy loam.

Permeability of the Manter 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, fringed sagewort and blue grama increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Moskee and Manter soils are in windbreak suitability group 3.

### **166—Noden fine sandy loam, 0 to 3 percent slopes**

This very deep, well drained soil is on alluvial fans. The soil formed in alluvium and eolian deposits derived from sandstone. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Jayem fine sandy loam, Hargreave fine sandy loam, and Moskee sandy loam.

Typically, the surface layer is grayish brown fine sandy loam 7 inches thick. The upper part of the subsoil is brown clay loam 18 inches thick. The next part is pale brown loam 7 inches thick. The lower part, to a depth of 41 inches, is pale brown fine sandy loam. The substratum, to a depth of 60 inches or more, is pale brown fine sandy loam.

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

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, little bluestem, and prairie sandreed. As the range condition deteriorates, blue grama and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. To avoid overirrigating and leaching of plant

nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Noden soil is in windbreak suitability group 3.

### **167—Orella-Cadoma-Rock outcrop complex, 3 to 25 percent slopes**

This map unit is on dissected plains. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Orella silty clay loam on slopes of 3 to 25 percent, 30 percent Cadoma silty clay loam on slopes of 3 to 20 percent, and 15 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 Shingle loam, Savageton clay loam, and shallow, loamy, alkaline soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Orella soil is shallow and well drained. It formed in residuum derived from sodic shale. Typically, the surface layer is light yellowish brown silty clay loam 3 inches thick. The upper 4 inches of the underlying material is light yellowish brown silty clay. The lower part is light yellowish brown clay 7 inches thick. Weakly consolidated shale is at a depth of 14 inches. This soil is strongly alkaline and slightly saline in all layers below the surface layer.

Permeability of the Orella soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Cadoma soil is moderately deep and well drained. It formed in alluvium derived from sodic shale. Typically, the surface layer is light yellowish brown silty clay loam 1 inch thick. The subsoil is light yellowish brown silty clay loam 10 inches thick. The substratum is light brownish gray silty clay 23 inches thick. Weakly consolidated shale is at a depth of 34 inches. This soil is strongly alkaline and slightly saline in the subsoil. It is very strongly alkaline and slightly saline in the substratum.

Permeability of the Cadoma soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed shale and sandstone.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, inland saltgrass, Sandberg bluegrass, alkali sacaton, greasewood, and gardner saltbush. As the range condition deteriorates, greasewood and gardner saltbush increase. The potential plant community produces about 500 pounds of air-dry vegetation per acre in normal years. Production varies from 650 pounds in favorable years to 250 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation, the salinity and alkalinity of both soils, and the droughtiness of the Orella soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds. The hazard of water erosion also limits mechanical range renovation and range seeding.

The Orella soil is in capability subclass VIIe, nonirrigated. The Cadoma soil is in capability subclass VIe, nonirrigated. The Rock outcrop is in capability class VIII. The Orella and Cadoma soils are in the Saline Upland, 10- to 14-inch precipitation, Northern Plains range site. The Orella soil is in windbreak suitability group 10. The Cadoma soil is in windbreak suitability group 9C.

### **168—Orpha, moist-Dailey loamy fine sands, 6 to 15 percent slopes**

This map unit is on dunes. The native vegetation is mainly mid and tall grasses, forbs, and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Orpha loamy fine sand on slopes of 6 to 15 percent, and 30 percent Dailey

loamy fine sand on slopes of 6 to 10 percent. 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 Manter fine sandy loam, Tullock loamy fine sand, and sandstone rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Orpha soil is very deep and excessively drained. It formed in eolian deposits derived from sandstone. Typically, the surface layer is brown loamy fine sand 3 inches thick. The upper part of the underlying material is pale brown loamy fine sand and fine sand 35 inches thick. The lower part, to a depth of 60 inches or more, is light yellowish brown fine sand.

Permeability of the Orpha 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 severe.

The Dailey soil is very deep and well drained. It formed in eolian deposits derived from sandstone. Typically, the surface layer is brown loamy fine sand 14 inches thick. The upper part of the underlying material is pale brown loamy fine sand 9 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sand.

Permeability of the Dailey 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly prairie sandreed, needleandthread, sand bluestem, sand sagebrush, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is poorly

suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used.

This map unit is in capability subclass Vle, nonirrigated. It is in the Sands, 15- to 17-inch precipitation, Southern Plains range site. These soils are in windbreak suitability group 7.

### **169—Orpha-Dwyer fine sands, 0 to 6 percent slopes**

This map unit is on valley sideslopes and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Orpha fine sand and 45 percent Dwyer fine sand. 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 Keeline fine sandy loam and Vonalee sandy loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Orpha soil is very deep and excessively drained. It formed in eolian deposits derived from various sources. Typically, the surface layer is brown fine sand 5 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

Permeability of the Orpha soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Dwyer soil is very deep and excessively drained. It formed in eolian deposits derived from various sources. Typically, the surface layer is brown fine sand 5 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown fine sand.

Permeability of the Dwyer soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, and needleandthread. As the range condition deteriorates,

annuals and broom snakeweed increase. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,700 pounds in favorable years to 900 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the soils and low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The potential for seepage losses limits the development of stockwater ponds. The hazard of wind erosion restricts range seeding. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass VIe, nonirrigated. It is in the Sands, 10- to 14-inch precipitation, Northern Plains range site. The Orpha and Dwyer soils are in windbreak suitability group 7.

### **170—Orpha-Dwyer-Taluce complex, 6 to 15 percent slopes**

This map unit is on valley sideslopes and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Orpha fine sand, 35 percent Dwyer fine sand, and 20 percent Taluce 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 Keeline fine sandy loam, Terro sandy loam, and Vonalee sandy loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Orpha soil is very deep and excessively drained. It formed in eolian deposits derived from various sources. Typically, the surface layer is brown fine sand 3 inches thick. The underlying material, to a depth of 60 inches or more, is yellowish brown and pale brown fine sand.

Permeability of the Orpha soil is very 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 severe.

The Dwyer soil is very deep and excessively drained. It formed in eolian deposits derived from various sources. Typically, the surface layer is pale brown fine sand 6 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown fine sand.

Permeability of the Dwyer soil is very 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 severe.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 4 inches thick. The underlying material is pale brown fine sandy loam 12 inches thick. Weakly consolidated sandstone is at a depth of 16 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Orpha and Dwyer soils is mainly prairie sandreed, sand bluestem, and needleandthread. As the range condition deteriorates, annuals and broom snakeweed increase. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,700 pounds in favorable years to 900 pounds in unfavorable years.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation and droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The

potential for seepage losses in the Orpha and Dwyer soils and the depth to bedrock in the Taluce soil limit the development of stockwater ponds. The hazard of wind erosion restricts range seeding. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer of all the soils and the droughtiness of the Taluce soil.

The Orpha and Dwyer soils are in capability subclass VIe, nonirrigated. The Taluce soil is in capability subclass VIIe, nonirrigated. The Orpha and Dwyer soils are in the Sands, 10- to 14-inch precipitation, Northern Plains range site. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Orpha and Dwyer soils are in windbreak suitability group 7. The Taluce soil is in windbreak suitability group 10.

### **171—Oxyaquic Torrifuents, 0 to 3 percent slopes**

This very deep, moderately well drained soil is in drainageways that occur below acidic shale hills. It formed in alluvium derived from acidic shale. The native vegetation is mainly tall grasses. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of very deep, well drained clayey soils on toeslopes of hills and on hummocks in the drainageways. Also included are small areas of somewhat poorly drained clayey soils in depressional areas. Included areas make up about 15 percent of the total acreage.

No single profile of the soils is typical as they are highly variable within short distances. Commonly, the surface layer is gray loam or clay loam 3 to 6 inches thick. The underlying material, to a depth of 60 inches or more, is commonly gray or grayish brown and highly stratified. Layers of clay, clay loam, and loam of variable thickness are most common.

Permeability is moderate to slow. Available water capacity is high. Effective rooting depth for most plants is 48 to 60 inches, but it is 60 inches or more for plants that can tolerate a water table. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A water table is at a depth of 4 to 6 feet from March to June. This soil is subject to a rare hazard of flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly prairie sandreed, prairie cordgrass, big bluestem, and wheatgrass. 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 3,500 pounds in unfavorable years. As the range condition deteriorates, annual grasses and forbs invade.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass Vw, nonirrigated. The Oxyaquic Torrifuents soil is in the Subirrigated, 10- to 14-inch precipitation, Northern Plains range site. This soil is in windbreak suitability group 1K.

### **172—Paiges clay loam, 3 to 10 percent slopes**

This moderately deep, well drained soil is on pediments. It formed in alluvium derived from acidic shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Grummit clay.

Typically, the surface layer is grayish brown clay loam 16 inches thick. The upper part of the underlying material is grayish brown clay loam 12 inches thick. The lower part is pale brown clay loam 11 inches thick. Weakly consolidated, very pale brown to brownish yellow acidic shale is at a depth of 39 inches.

Permeability is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly prairie sandreed, little bluestem, western wheatgrass, and silver sagebrush. As the range condition deteriorates, silver sagebrush and rabbitbrush increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,550 pounds in favorable years to 650 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should also be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Porous Clay, 10- to 14-inch precipitation, Northern Plains range site. The Paiges soil is in windbreak suitability group 4C.

### **173—Phiferson-Tassel-Rock outcrop complex, 6 to 30 percent slopes**

This map unit is on valley sideslopes and hills. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Phiferson loamy very fine sand on slopes of 6 to 25 percent, 30 percent Tassel loamy fine sand on slopes of 6 to 30 percent, and 15 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 Vetal very fine sandy loam, Jayem fine sandy loam, and Busher loamy very fine sand. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark brown loamy very fine sand 11 inches thick. The upper part of the subsoil is brown loamy very fine sand 20 inches thick. The lower part is pale brown loamy very fine sand 7 inches thick. Weakly consolidated sandstone is at a depth of 38 inches. This Phiferson soil is outside the characteristics defined for the Phiferson series because it does not contain calcium carbonate in any part of the profile. Also, the subsoil contains more very fine sand. These differences, however, do not significantly affect the use and management of the soil.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Tassel soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is light brownish gray loamy fine sand 2 inches thick. The underlying material is pale brown loamy very fine sand 10 inches thick. Weakly consolidated sandstone is at a depth of 12 inches.

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

Rock outcrop consists of ledges and ridges of weakly consolidated sandstone.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Phiferson soil is mainly needleandthread, prairie sandreed, little bluestem, and thickspike wheatgrass. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 potential plant community on the Tassel soil is mainly little bluestem, needleandthread, Indian ricegrass, and western wheatgrass. As the range condition deteriorates, threadleaf sedge, red threeawn, and broom snakeweed increase. 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 vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the Tassel soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Phiferson soil is in capability subclass VIe, nonirrigated. The Tassel soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII. The Phiferson soil is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Tassel soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Phiferson soil is in windbreak suitability group 6D. The Tassel soil is in windbreak suitability group 10.

### **174—Phiferson-Trelona fine sandy loams, 3 to 10 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,600 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Phiferson fine sandy loam and 40 percent Trelona 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 Jayem fine sandy loam, Alice fine sandy loam, Busher fine sandy loam, and sandstone rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 6 inches thick. The upper part of the subsoil is brown very fine sandy loam 10 inches thick. The lower part is pale brown very fine sandy loam 10 inches thick. Weakly consolidated sandstone is at a depth of 26 inches. This Phiferson soil is outside the characteristics defined for the Phiferson series because the subsoil contains more very fine sand. This difference, however, does not significantly affect the use and management of the soil.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Trelona soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 7 inches thick. The underlying material is brown fine sandy loam 7 inches thick. Weakly consolidated sandstone is at a depth of 14 inches.

Permeability of the Trelona 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Phiferson soil is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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 potential plant community on the Trelona soil is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and blue grama increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses and the depth to bedrock. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically

feasible due to the coarse texture of the surface layers.

The Phiferson soil is in capability subclass IVe, nonirrigated. The Trelona soil is in capability subclass VIe, nonirrigated. The Phiferson soil is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Trelona soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Phiferson soil is in windbreak suitability group 6D. The Trelona soil is in windbreak suitability group 10.

### **175—Pierre silty clay, 6 to 15 percent slopes**

This moderately deep, well drained soil is on hillslopes. It formed in residuum derived from shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Bahl clay and Samday silty clay.

Typically, the surface layer is olive silty clay 3 inches thick. The upper part of the subsoil is grayish brown clay 17 inches thick. The lower part is light brownish gray clay 12 inches thick. Weakly consolidated shale is at a depth of 32 inches.

Permeability is very slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Pierre soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the depth to bedrock. It is moderately well suited for mechanical range renovation and range seeding. The main limitations are the hazard of water

erosion and the clayey surface layer. The low annual precipitation should also be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should also be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Pierre soil is in windbreak suitability group 4CK.

### **176—Pierre-Grummit clays, 6 to 25 percent slopes**

This map unit is on hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Pierre clay and 40 percent Grummit clay. The components of this unit are so intricately intermingled that it is not practical to map them separately at the scale used.

Included in this unit are small areas of Samday clay and shale rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Pierre soil is moderately deep and well drained. It formed in residuum derived from shale. Typically, the surface layer is grayish brown clay 4 inches thick. The subsoil is light brownish gray clay 25 inches thick. The substratum is light brownish gray clay 5 inches thick. Weakly consolidated shale is at a depth of 34 inches.

Permeability of the Pierre soil is very slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Grummit soil is shallow and well drained. It formed in residuum derived from acidic shale. Typically, the surface layer is light brownish gray clay 4 inches thick. The underlying material is grayish brown clay 7 inches thick. Weakly consolidated, acidic shale is at a depth of 11 inches.

Permeability of the Grummit soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The unit is used for rangeland and wildlife habitat.

The potential plant community on the Pierre soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Grummit soil is mainly western wheatgrass, bluebunch wheatgrass, and green needlegrass. As the range condition deteriorates, broom snakeweed and annuals increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the Grummit soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the steepness of slope and depth to bedrock. It is poorly suited for mechanical range renovation and range seeding due to the steepness of slope and the hazard of water erosion. Tillage for range improvement is not recommended. Interseeding and seedbed preparation by band spraying of herbicides can be used.

The Pierre soil is in capability subclass VIe, nonirrigated. The Grummit soil is in capability subclass VIIe, nonirrigated. The Pierre soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Grummit soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Pierre soil is in windbreak suitability group 4CK. The Grummit soil is in windbreak suitability group 10.

### **177—Recluse loam, dry, 0 to 6 percent slopes**

This very deep and well drained soil is on tablelands and alluvial fans (fig. 5). It formed in alluvium and eolian deposits derived from various sedimentary sources. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 4,000 to 4,800 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Albinas loam and Threetop loam.

Typically, the surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is grayish brown clay loam 5 inches thick. The next part is light brownish gray clay loam 14 inches thick. The lower part is pale brown loam 13 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown loam.

Permeability 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 for rangeland and wildlife habitat. Some areas that were formerly cultivated have been seeded to grass pastures.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

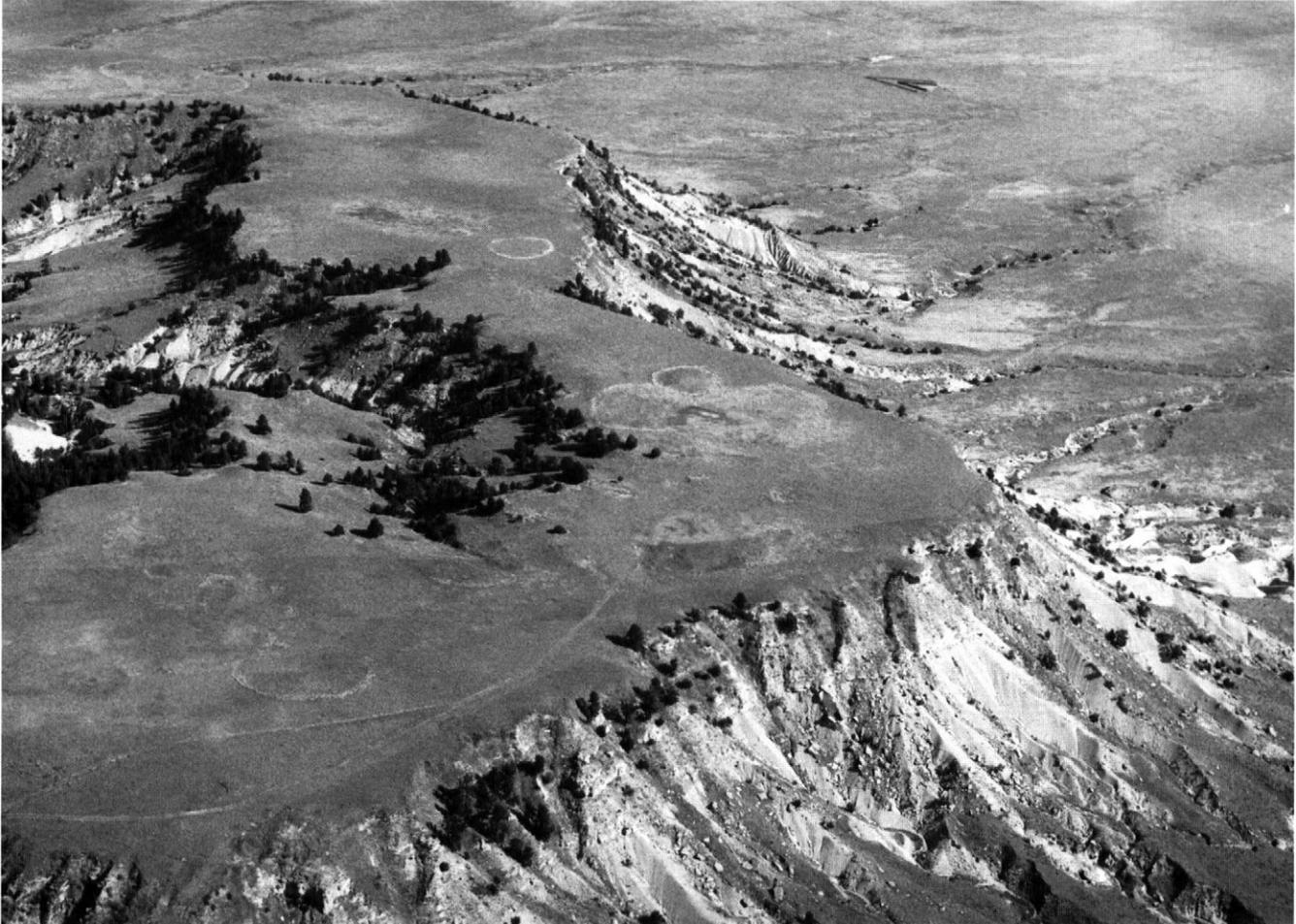
If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Recluse soil is in windbreak suitability group 3.

### **178—Recluse-Cedak loams, 0 to 6 percent slopes**

This map unit is on toeslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature



**Figure 5. An area of the Seaman Hills. Map unit 177 - Recluse loam, dry, 0 to 6 percent slopes, is on the tablelands above the hillslopes. The hillslopes are detailed map unit 211 - Torriorthents, very steep.**

is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Recluse loam and 30 percent Cedak 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 Manter sandy loam, Moskee sandy loam, and Albinas loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Recluse soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is grayish brown loam 11 inches thick. The subsoil is brown and pale brown clay loam 18 inches thick. The upper part of the substratum is light brownish gray loam 9 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray very fine sandy loam.

Permeability of the Recluse 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 Cedak soil is moderately deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is grayish brown and brown loam 11 inches thick. The lower part is light brownish gray very fine sandy loam 14 inches thick. Weakly consolidated sandstone is at a depth of 29 inches.

Permeability of the Cedak 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 moderate.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue

grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Cedak soil also limits the development of stockwater ponds. This unit is well suited for mechanical range renovation and reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

If this unit is used for irrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

The Recluse soil is in capability subclass IIIe, irrigated and nonirrigated. The Cedak soil is in capability subclass IIIe, irrigated and IVe, nonirrigated. This map unit is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Recluse soil is in windbreak suitability group 3. The Cedak soil is in windbreak suitability group 6D.

### **179—Recluse-Cedak loams, 6 to 10 percent slopes**

This map unit is on footslopes and shoulder slopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Recluse loam and 40 percent Cedak 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 Vetal and Phiferson fine sandy loams. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Recluse soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 13 inches thick. The upper part of the subsoil is grayish brown loam and clay loam 10 inches thick. The lower part is pale brown loam 12 inches thick. The substratum, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Recluse 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 Cedak soil is moderately deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is dark grayish brown loam 8 inches thick. The upper part of the subsoil is brown clay loam 11 inches thick. The lower part is pale brown very fine sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 32 inches.

Permeability of the Cedak soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, and blue grama. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Cedak soil also limits the development of stockwater ponds. This unit is moderately well

suited for mechanical range renovation and reseeding. The main limitation is the hazard of water erosion. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

If this unit is used for nonirrigated cropland, the main limitations are the hazards of wind erosion and water erosion. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces runoff, water erosion, and wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazards of wind erosion and water erosion and steepness of slope. Maintaining crop residue on or near the surface reduces runoff, water erosion, and wind erosion. Because of the steepness of slope, sprinkler irrigation is the best method. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Loamy, 15- to 17-inch precipitation, Southern Plains range site. The Recluse soil is in windbreak suitability group 3. The Cedak soil is in windbreak suitability group 6D.

### **180—Rhoame-Bahl clays, 0 to 6 percent slopes**

This map unit is on alluvial fans and footslopes of hills. The native vegetation is mainly grasses and forbs. Elevation is 4,000 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Rhoame clay and 40 percent Bahl clay. 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 Savageton clay. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Rhoame soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the upper part of the surface layer is grayish brown clay 3 inches thick. The upper part of the underlying material is grayish brown clay 7 inches thick. The

next part is light brownish gray clay 25 inches thick. The lower part, to a depth of 60 inches or more, is grayish brown clay.

Permeability of the Rhoame soil is slow. 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 Bahl soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown clay 3 inches thick. The underlying material, to a depth of 60 inches, is grayish brown clay.

Permeability of the Bahl soil is slow. 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 for rangeland and wildlife habitat.

The potential plant community on the Rhoame soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Bahl soil is mainly green needlegrass, western wheatgrass, and birdfoot sagebrush. As the range condition deteriorates, birdfoot sagebrush and big sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be considered when reseeding.

This map unit is in capability subclass IVs, nonirrigated. The Rhoame soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Bahl soil is in the Dense Clay, 10- to 14-inch precipitation, Northern Plains range site. The Rhoame soil is in windbreak suitability group 4C. The Bahl soil is in windbreak suitability group 4CK.

### 181—Rock outcrop

This map unit consists of areas of exposed sandstone and shale bedrock. Included in this unit is about 10 percent shallow soils in drainageways.

This unit is used for wildlife habitat. It is in capability class VIII.

### 182—Rock outcrop-Tassel complex, 6 to 70 percent slopes

This map unit is on valley sideslopes and ridges. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Rock outcrop and 40 percent Tassel loamy fine sand. 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 Trelona fine sandy loam, Turnercrest fine sandy loam, Phiferson fine sandy loam, and very shallow loamy fine sand soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of ledges and ridges of exposed weakly consolidated sandstone.

The Tassel soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is pale brown loamy fine sand 3 inches thick. The underlying material is pale brown loamy fine sand 8 inches thick. Weakly consolidated sandstone is at a depth of 11 inches. The Tassel soil is outside the characteristics defined for the Tassel series because it has coarser texture. This difference, however, does not significantly affect the use and management of the soil.

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

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Tassel soil is mainly little bluestem, needleandthread, Indian ricegrass, and western wheatgrass. As the range condition deteriorates, threadleaf sedge, red threeawn, and broom snakeweed increase. 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. Production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the depth to bedrock and steepness of slope.

Rock outcrop is in capability class VIII. The Tassel soil is in capability subclass VIIe, nonirrigated. The Tassel soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Tassel soil is in windbreak suitability group 10.

### 183—Samday clay, 3 to 10 percent slopes

This shallow, well drained soil is on ridges and hillslopes. It formed in residuum derived from shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Shingle loam and Savageton clay loam.

Typically, the surface layer is light olive brown clay 3 inches thick. The underlying material is light yellowish brown clay 10 inches thick. Weakly consolidated shale is at a depth of 13 inches.

Permeability is slow. 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 unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be

managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for mechanical range renovation and range seeding. The depth to bedrock limits the development of stockwater ponds. Mechanical range renovation may not be economically feasible due to the droughtiness of the soil. If range seedings are conducted, plant species should be carefully selected because of the droughtiness of the soil.

This map unit is in capability subclass VIIe, nonirrigated. It is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Samday soil is in windbreak suitability group 10.

### **184—Samday-Pierre clays, 3 to 30 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Samday clay and 30 percent Pierre clay. 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 Bahl clay and shale rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Samday soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is grayish brown clay 3 inches thick. The underlying material is grayish brown and olive gray clay 15 inches thick. Weakly consolidated shale is at a depth of 18 inches.

Permeability of the Samday soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

The Pierre soil is moderately deep and well drained. It formed in residuum derived from shale. Typically, the surface layer is grayish brown clay 4 inches thick. The upper part of the subsoil is grayish brown clay 22 inches thick. The lower part is light olive gray clay 6 inches thick. Weakly consolidated shale is at a depth of 32 inches.

Permeability of the Pierre soil is very slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of

water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Samday soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The potential plant community on the Pierre soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The production of vegetation for livestock grazing is limited by the droughtiness of the Samday soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds. The hazard of water erosion also limits range seeding.

The Samday soil is in capability subclass VIIe, nonirrigated. The Pierre soil is in capability subclass VIe, nonirrigated. The Samday soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Pierre soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Samday soil is in windbreak suitability group 10. The Pierre soil is in windbreak suitability group 4DK.

### **185—Samday-Savageton-Bahl association, 3 to 10 percent slopes**

This map unit is on hills and ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Samday clay on hills and ridges, 25 percent Savageton clay loam on hills and ridges, and 15 percent Bahl clay loam on footslopes

of hills. 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 Grummit clay loam, Petrie clay, and shale rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Samday soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light olive brown clay 3 inches thick. The underlying material is light yellowish brown clay 10 inches thick. Weakly consolidated shale is at a depth of 13 inches.

Permeability of the Samday soil is slow. 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.

The Savageton soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light gray clay loam 5 inches thick. The upper part of the subsoil is light gray clay 6 inches thick. The lower part is light gray clay 13 inches thick. Weakly consolidated shale is at a depth of 24 inches.

Permeability of the Savageton soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Bahl soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is light brownish gray clay loam 6 inches thick. The upper part of the underlying material is light brownish gray clay 6 inches thick. The lower part, to a depth of 60 inches, is light brownish gray clay.

Permeability of the Bahl soil is slow. 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 for rangeland and wildlife habitat.

The potential plant community on the Samday soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The potential plant community on the Savageton soil is mainly western wheatgrass, green needlegrass,

and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Bahl soil is mainly western wheatgrass, green needlegrass, and birdfoot sagebrush. As the range condition deteriorates, sagebrush increases. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the Samday soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Samday and Savageton soils are poorly suited for stockwater ponds due to the depth to bedrock. The Bahl soil is well suited for stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

The Samday soil is in capability subclass VIIe, nonirrigated. The Savageton and Bahl soils are in capability subclass IVe, nonirrigated. The Samday soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Savageton soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Bahl soil is in the Dense Clay, 10- to 14-inch precipitation, Northern Plains range site. The Samday soil is in windbreak suitability group 10. The Savageton and Bahl soils are in windbreak suitability group 4CK.

### **186—Savageton-Bahl clay loams, 3 to 10 percent slopes**

This map unit is on footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature

is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Savageton clay loam and 40 percent Bahl clay 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 Petrie clay and Samday clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Savageton soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light gray clay loam 5 inches thick. The upper part of the subsoil is light gray clay 6 inches thick. The lower part is light gray clay 13 inches thick. Weakly consolidated shale is at a depth of 24 inches.

Permeability of the Savageton soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Bahl soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown clay loam 1 inch thick. The upper part of the underlying material is light brownish gray clay 13 inches thick. The lower part to a depth of 60 inches is light brownish gray clay containing many masses of gypsum.

Permeability of the Bahl soil is slow. 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 for rangeland and wildlife habitat.

The potential plant community on the Savageton soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Bahl soil is mainly western wheatgrass, green needlegrass, and birdfoot sagebrush. As the range condition deteriorates, sagebrush increases. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the

range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Savageton soil is poorly suited for stockwater ponds due to the depth to bedrock. The Bahl soil is well suited for stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The low annual precipitation should also be considered when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. The Savageton soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Bahl soil is in the Dense Clay, 10- to 14-inch precipitation, Northern Plains range site. The Savageton and Bahl soils are in windbreak suitability group 4CK.

### **187—Schamber-Tulloch complex, 3 to 30 percent slopes**

This map unit is on terrace escarpments. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 60 percent Schamber gravelly loamy sand and 20 percent Tullock loamy fine sand. 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 Keeline fine sandy loam, very gravelly soils, and sandstone rock outcrop. Included areas make up 20 percent of the total acreage. The percentage varies from one area to another.

The Schamber soil is very deep and excessively drained. It formed in very gravelly outwash alluvium derived from various sources. Typically, the surface layer is light olive brown gravelly loamy sand 2 inches thick. The upper part of the underlying material is brownish yellow very gravelly sand 13 inches thick. The lower part to a depth of 60 inches or more is pale yellow very gravelly sand.

Permeability of the Schamber soil is rapid. 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 moderate.

The Tullock soil is moderately deep and excessively drained. It formed in eolian deposits and residuum derived from sandstone. Typically, the surface layer is brown loamy fine sand 3 inches thick. The upper part of the underlying material is pale brown loamy fine sand 6 inches thick. The lower part is very pale brown loamy fine sand 15 inches thick. Weakly consolidated sandstone is at a depth of 24 inches.

Permeability of the Tullock soil is rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community of the Schamber soil is mainly needleandthread, prairie sandreed, little bluestem, and bluebunch wheatgrass. As the range condition deteriorates, threadleaf sedge, blue grama, and yucca increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community of the Tullock soil is mainly needleandthread, sand bluestem, and prairie sandreed. As the range condition deteriorates, threadleaf sedge and silver sagebrush increase. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,700 pounds in favorable years to 900 pounds in unfavorable years.

Production of vegetation suitable for livestock grazing is limited by the low annual precipitation and droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope.

The Schamber soil is in capability subclass VI<sub>1</sub>, nonirrigated. The Tullock soil is in capability subclass VI<sub>2</sub>, nonirrigated. The Schamber soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Tullock soil is in the Sands, 10- to 14-inch precipitation, Northern Plains range site. The

Schamber soil is in windbreak suitability group 10. The Tullock soil is in windbreak suitability group 6.

### **188—Senlar silt loam, 0 to 3 percent slopes**

This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from siltstone. The native vegetation is mainly grasses and shrubs. Elevation is 4,200 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Keeline fine sandy loam, Kishona loam, and Cambria loam.

Typically, the surface layer is light gray silt loam 2 inches thick. The upper part of the subsoil is very pale brown silt loam 14 inches thick. The next part is light gray silt loam 12 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown very fine sandy loam stratified with thin layers of fine sandy loam and silt loam.

Permeability 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Senlar soil is in windbreak suitability group 8.

### **189—Shingle-Rock outcrop-Samday complex, 10 to 30 percent slopes**

This map unit is on ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Shingle loam, 20 percent Rock outcrop, and 20 percent Samday clay. 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 Theedle loam, Hilight clay, and Savageton clay. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Shingle soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is pale brown loam 6 inches thick. The underlying material is pale brown loam 11 inches thick. Weakly consolidated shale is at a depth of 17 inches.

Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

Rock outcrop consists of areas of exposed sandstone and shale.

The Samday soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay 3 inches thick. The underlying material is light gray clay 11 inches thick. Weakly consolidated shale is at a depth of 14 inches.

Permeability of the Samday soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces

about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 450 pounds in unfavorable years.

The potential plant community on the Samday soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. As the range condition deteriorates, big sagebrush and birdfoot sagebrush increase. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil and low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Shingle and Samday soils are in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Samday soil is in the Shallow Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Shingle and Samday soils are in windbreak suitability group 10.

### **190—Silhouette silt loam, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from shale. The native vegetation is mainly short and mid grasses, forbs, and scattered shrubs. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Kishona loam and Cambria loam.

Typically, the surface layer is light brownish gray silt loam 2 inches thick. The upper part of the subsoil is light brownish gray silty clay loam 13 inches thick. The lower part is light gray and very pale brown silty clay loam 19 inches thick. The substratum, to a depth of 60 inches or more, is light gray silty clay.

Permeability 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 moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be considered when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Silhouette soil is in windbreak suitability group 4CK.

### **191—Skilak-Kishona complex, 0 to 6 percent slopes**

This map unit is on alluvial fans and terraces. The native vegetation is mainly short and mid grasses. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Skilak silty clay and 35 percent Kishona clay 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 Forkwood loam and Cambria loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Skilak soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light yellowish brown silty clay 3 inches thick. The subsoil is light yellowish

brown silty clay loam 4 inches thick. The upper part of the substratum is pale yellow silt loam 9 inches thick. The lower part, to a depth of 60 inches or more, is pale yellow silt loam containing thin strata of very fine sandy loam.

Permeability of the Skilak 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 Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light brownish gray clay loam 4 inches thick. The subsoil is light brownish gray clay loam 5 inches thick. The upper part of the substratum is light yellowish brown silty clay loam 26 inches thick. The lower part, to a depth of 60 inches or more, is very pale brown loam.

Permeability of the Kishona 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Skilak soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, blue grama and big sagebrush increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Kishona soil is mainly western wheatgrass, needleandthread, green needlegrass, and blue grama. As the range condition deteriorates, blue grama and big sagebrush increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and range seeding. The low annual precipitation should be considered when

reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. The Skilak soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Kishona soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. These soils are in windbreak suitability group 8.

### **192—Sunup-Rock outcrop complex, 10 to 40 percent slopes**

This map unit is on ridges and hillslopes. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 4,200 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 65 percent Sunup very cobbly 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 moderately deep cobbly soils in drainageways. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sunup soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown very cobbly fine sandy loam 2 inches thick. The underlying material is brown very cobbly sandy clay loam 8 inches thick. Hard, fractured sandstone is at a depth of 10 inches. This Sunup soil is outside the characteristics of the Sunup series because it does not contain calcium carbonate and is less alkaline. This difference, however, does not significantly affect the use and management of the soil.

Permeability of the Sunup soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is slight.

Rock outcrop consists of areas of exposed hard, fractured, sandstone.

This unit is used for wildlife habitat and rangeland.

The potential plant community on the Sunup soil is mainly bluebunch wheatgrass, little bluestem, and western wheatgrass. As the range condition

deteriorates, woody plants increase. The potential plant community produces about 350 pounds of air-dry vegetation per acre in normal years. Production varies from 500 pounds in favorable years to 250 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by the droughtiness of the soil and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Sunup soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII. The Sunup soil is in the Very Shallow, 10- to 14-inch precipitation, Northern Plains range site. The Sunup soil is in windbreak suitability group 10.

### **193—Taluce, cool-Keeline fine sandy loams, 6 to 40 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly short and mid grasses and ponderosa pine. Elevation is 3,800 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Taluce fine sandy loam, cool, on slopes of 6 to 40 percent and 30 percent Keeline fine sandy loam on slopes of 6 to 20 percent. The Taluce soil is on the upper part of the hillslopes and on hillcrests and the Keeline soil is on footslopes of the hills. 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 Kishona loam, Sunup fine sandy loam, Turnercrest fine sandy loam, and sandstone rock outcrop. Included areas make up 20 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is light brownish gray fine sandy loam 4 inches thick. The underlying material is light gray fine sandy loam 12 inches thick. Weakly consolidated sandstone is at a depth of 16 inches.

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

The Keeline soil is very deep and well drained. It formed in alluvium and eolian deposits derived from various sources. Typically, the surface layer is light brownish gray fine sandy loam 4 inches thick. The upper part of the underlying material is light yellowish brown fine sandy loam 14 inches thick. The lower part, to a depth of 60 inches or more, is pale yellow fine sandy loam.

Permeability of the Keeline 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly ponderosa pine with an understory of bluebunch wheatgrass, needleandthread, prairie sandreed, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 800 pounds in favorable years to 400 pounds in unfavorable years.

The potential plant community on the Keeline soil is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock in the Taluce soil and the potential for seepage losses in the Keeline soil also limit the development of stockwater ponds.

The Taluce soil is in capability subclass VIIe, nonirrigated. The Keeline soil is in capability subclass VIe, nonirrigated. The Taluce soil is in the Grazeable Woodland site, 10- to 14-inch precipitation, Northern Plains zone. The Keeline soil is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Taluce, cool soil is in windbreak suitability group 10. The Keeline soil is in windbreak suitability group 8.

### **194—Taluce-Rock outcrop-Shingle complex, 6 to 45 percent slopes**

This map unit is on ridges and hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 30 percent Taluce fine sandy loam, 25 percent Rock outcrop, and 25 percent Shingle 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 Theedle loam, Turnercrest fine sandy loam, and Keeline fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The underlying material is light gray fine sandy loam 11 inches thick. Weakly consolidated sandstone is at a depth of 16 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Rock outcrop consists of areas of exposed sandstone and shale.

The Shingle soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is pale brown loam 6 inches thick. The underlying material is pale brown loam 11 inches thick. Weakly consolidated shale is at a depth of 17 inches.

Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the soils and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Taluce and Shingle soils are in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability class VIII. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Taluce and Shingle soils are in windbreak suitability group 10.

### **195—Taluce-Rock outcrop-Turnercrest complex, 6 to 50 percent slopes**

This map unit is on hillslopes and ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Taluce fine sandy loam on slopes of 6 to 50 percent, 30 percent Rock outcrop on slopes of 6 to 50 percent, and 20 percent Turnercrest fine sandy loam on slopes of 6 to 30 percent. 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 Shingle loam, Terro sandy loam, and Keeline fine sandy loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is yellowish brown fine sandy loam 4

inches thick. The underlying material is light gray fine sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 17 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Rock outcrop consists of areas of exposed sandstone.

The Turnercrest soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam 4 inches thick. The underlying material is brown and light gray fine sandy loam 31 inches thick. Weakly consolidated sandstone is at a depth of 35 inches.

Permeability of the Turnercrest soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Turnercrest soil is mainly needleandthread, prairie sandreed, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Taluce soil is in capability subclass VIIe, nonirrigated. Rock outcrop is in capability class VIII. The Turnercrest soil is in capability subclass VIe,

nonirrigated. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Turnercrest soil is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Taluce soil is in windbreak suitability group 10. The Turnercrest soil is in windbreak suitability group 6DK.

### **196—Taluce-Shingle complex, 3 to 20 percent slopes**

This map unit is on ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Taluce fine sandy loam and 30 percent Shingle 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 Theedle loam, Turnercrest fine sandy loam, Keeline sandy loam, and sandstone rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 5 inches thick. The underlying material is very pale brown fine sandy loam 11 inches thick. Weakly consolidated sandstone is at a depth of 16 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Shingle soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is pale brown loam 6 inches thick. The underlying material is pale brown loam 11 inches thick. Weakly consolidated shale is at a depth of 17 inches.

Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces

about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, and needleandthread. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the soils and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

This map unit is in capability subclass VIIe, nonirrigated. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation, Northern Plains range site. These soils are in windbreak suitability group 10.

### **197—Taluce-Tulloch-Rock outcrop complex, 3 to 45 percent slopes**

This map unit is on ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Taluce fine sandy loam, 20 percent Tulloch loamy fine sand, and 20 percent sandstone 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 Keeline fine sandy loam, Dwyer fine sand, Orpha fine sand, and Turnercrest fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is light olive brown fine sandy loam 4 inches thick. The upper part of the underlying

material is light olive brown fine sandy loam 6 inches thick. The lower part is light olive brown fine sandy loam 6 inches thick. Weakly consolidated sandstone is at a depth of 16 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Tullock soil is moderately deep and excessively drained. It formed in residuum and eolian deposits derived from sandstone. Typically, the surface layer is light olive brown loamy fine sand 4 inches thick. The upper 20 inches of the underlying material is light olive brown and light yellowish brown loamy fine sand. The lower part is olive yellow loamy sand 6 inches thick. Weakly consolidated sandstone is at a depth of 30 inches.

Permeability of the Tullock soil is rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Rock outcrop consists of areas of exposed sandstone.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly bluebunch wheatgrass, needleandthread, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 350 pounds of air-dry vegetation per acre in normal years. Production varies from 500 pounds in favorable years to 250 pounds in unfavorable years.

The potential plant community on the Tullock soil is mainly sand bluestem, needleandthread, and prairie sandreed. As the range condition deteriorates, blue grama increases and cheatgrass invades. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 1,700 pounds in favorable years to 900 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the low annual precipitation and the droughtiness of the soils. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

The Taluce soil is in capability subclass VIIe, nonirrigated. The Tullock soil is in capability subclass VIe, nonirrigated. The Rock outcrop is in capability class VIII. The Taluce soil is in the Very Shallow, 10- to 14-inch precipitation, Northern Plains range site. The Tullock soil is in the Sands, 10- to 14-inch precipitation, Northern Plains range site. The Taluce soil is in windbreak suitability group 10. The Tullock soil is in windbreak suitability group 6.

### **198—Taluce-Turnercrest-Keeline fine sandy loams, 3 to 20 percent slopes**

This map unit is on hills and adjacent alluvial fans. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Taluce fine sandy loam on slopes of 3 to 20 percent, 30 percent Turnercrest fine sandy loam on slopes of 6 to 20 percent, and 20 percent Keeline fine sandy loam on slopes of 3 to 20 percent. The Taluce and Turnercrest soils are on the hills and the Keeline soil is on the footslopes of hills and alluvial fans. 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 Shingle loam, Terro sandy loam, and sandstone Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is yellowish brown fine sandy loam 5 inches thick. The underlying material is light gray fine sandy loam 12 inches thick. Weakly consolidated sandstone is at a depth of 17 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Turnercrest soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam 4 inches thick. The underlying material is brown and light gray fine sandy loam 31 inches thick. Weakly consolidated sandstone is at a depth of 35 inches.

Permeability of the Turnercrest soil is moderately rapid. Available water capacity is low. Effective rooting

depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Keeline soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is light yellowish brown fine sandy loam 3 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown and light yellowish brown fine sandy loam.

Permeability of the Keeline 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Turnercrest and Keeline soils is mainly needleandthread, prairie sandreed, western wheatgrass, threadleaf sedge, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by droughtiness of the Taluce soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the steepness of slope and the potential for seepage losses. The depth to bedrock in the Taluce and Turnercrest soils also limits the development of stockwater ponds. This unit is poorly suited for mechanical range renovation and range seeding. The main limitations are the steepness of slope and the hazards of wind erosion and water erosion. Tillage for range improvement is not recommended.

The Taluce soil is in capability subclass VIe, nonirrigated. The Turnercrest and Keeline soils are in

capability subclass VIe, nonirrigated. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site precipitation zone. The Turnercrest and Keeline soils are in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Taluce soil is in windbreak suitability group 10. The Turnercrest soil is in windbreak suitability group 6DK. The Keeline soil is in windbreak suitability group 8.

### **199—Tassel-Ponderosa-Rock outcrop association, 9 to 70 percent slopes.**

This map unit is on ridges and hillslopes. The native vegetation is mainly grasses, shrubs, and ponderosa pine. Elevation is 4,500 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Tassel loamy fine sand on slopes of 9 to 70 percent, 30 percent Ponderosa loamy very fine sand on slopes of 9 to 60 percent, and 20 percent Rock outcrop on slopes of 9 to 70 percent. 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 Phiferon fine sandy loam and Trelona fine sandy loam. Included areas make up about 5 percent of the total acreage. The percentage varies from one area to another.

The Tassel soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is pale brown loamy fine sand 3 inches thick. The underlying material is pale brown loamy fine sand 8 inches thick. Weakly consolidated sandstone is at a depth of 11 inches. This Tassel series because it is slightly coarser textured. This difference, however, does not significantly affect the use and management of the soil.

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

The Ponderosa soil is very deep and well drained. It formed in colluvium derived from sandstone. Typically, the surface layer is grayish brown loamy very fine sand 13 inches thick. The next layer is light brownish gray loamy very fine sand 9 inches thick. The underlying material, to a depth of 60 inches or more, is light brownish gray and very pale brown loamy very fine sand.

Permeability of the Ponderosa 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 severe. The hazard of wind erosion is severe.

Rock outcrop consists of areas of exposed sandstone.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Tassel soil is mainly little bluestem, needleandthread, Indian ricegrass, and western wheatgrass. A few ponderosa pine are also part of the plant community. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 potential plant community on the Ponderosa soil is mainly needleandthread, prairie sandreed, little bluestem, threadleaf sedge, and thickspike wheatgrass. A few ponderosa pine are also part of the plant community. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the Tassel soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope.

The Tassel and Ponderosa soils are in capability subclass VIIe. Rock outcrop is in capability class VIII. The Tassel soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Ponderosa soil is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Tassel soil is in windbreak suitability group 10. The Ponderosa soil is in windbreak suitability group 3.

## **200—Tassel-Trelona-Phiferson fine sandy loams, 3 to 10 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to

17 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 30 percent Tassel fine sandy loam, 25 percent Trelona fine sandy loam, and 25 percent Phiferson 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 Keeline sandy loam and Turnercrest fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tassel soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam 2 inches thick. The underlying material is light yellowish brown loamy very fine sand 12 inches thick. Weakly consolidated sandstone is at a depth of 14 inches.

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

The Trelona soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 7 inches thick. The underlying material is pale brown fine sandy loam 10 inches thick. Weakly consolidated sandstone is at a depth of 17 inches.

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

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam 7 inches thick. The upper part of the subsoil is light yellowish brown fine sandy loam 14 inches thick. The lower part is very pale brown very fine sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 34 inches.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Tassel and Trelona soils is mainly needleandthread, western wheatgrass, Indian ricegrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and

fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by droughtiness of the soils.

The potential plant community on the Phiferson soil is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the depth to bedrock. It is moderately suited for mechanical range renovation and range seeding. The main limitations are the droughtiness of the Tassel and Trelona soils and the hazard of wind erosion. If range seedings are conducted, plant species should be carefully selected because of the droughtiness of the soils. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers and the droughtiness of the soils.

The Tassel soil is in capability subclass VIIe, nonirrigated. The Trelona soil is in capability subclass VIe, nonirrigated. The Phiferson soil is in capability subclass IVe, nonirrigated. The Tassel and Trelona soils are in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Phiferson soil is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Tassel and Trelona soils are in windbreak suitability group 10. The Phiferson soil is in windbreak suitability group 6D.

## **201—Terro-Turnercrest sandy loams, 2 to 10 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to

14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Terro sandy loam and 30 percent Turnercrest 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 Vonalee sandy loam and Keeline sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Terro soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is light brownish gray sandy loam 8 inches thick. The upper part of the subsoil is pale brown sandy loam 16 inches thick. The lower part is light brownish gray sandy loam 12 inches thick. Weakly consolidated sandstone is at a depth of 36 inches.

Permeability of the Terro soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Turnercrest soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown sandy loam 6 inches thick. The underlying material is light gray fine sandy loam 19 inches thick. Weakly consolidated sandstone is at a depth of 25 inches.

Permeability of the Turnercrest soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the depth to bedrock and the potential for seepage

losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Terro soil is in windbreak suitability group 6D. The Turnercrest soil is in windbreak suitability group 6DK.

## **202—Terro-Vonalee sandy loams, 0 to 6 percent slopes**

This map unit is on alluvial fans, terraces, and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Terro sandy loam and 40 percent Vonalee 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 Keeline fine sandy loam, Turnercrest fine sandy loam, and Hiland fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Terro soil is moderately deep and well drained. It formed in residuum and eolian deposits derived from sandstone. Typically, the surface layer is brown sandy loam 3 inches thick. The upper part of the subsoil is brown sandy loam 13 inches thick. The next 6 inches is pale brown fine sandy loam. The lower part is very pale brown fine sandy loam 14 inches thick. Weakly consolidated sandstone is at a depth of 36 inches.

Permeability of the Terro soil is moderately rapid. Available water capacity is low. 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 severe.

The Vonalee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is brown sandy loam 3 inches thick. The upper part of the subsoil is yellowish brown sandy

loam 8 inches thick. The next part is pale brown fine sandy loam 13 inches thick. The lower part, to a depth of 60 inches or more, is light yellowish brown loamy fine sand.

Permeability of the Vonalee soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama and cheatgrass increase. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses in both soils and the depth to bedrock in the Terro soil. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Terro soil is in windbreak suitability group 6D. The Vonalee soil is in windbreak suitability group 3.

## **203—Terro-Vonalee-Taluce association, 6 to 30 percent slopes**

This map unit is on hillslopes and ridges. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Terro fine sandy loam, 6 to 20 percent slopes, 25 percent Vonalee fine sandy loam, 6 to 15 percent slopes, and 25 percent Taluce fine sandy loam, 6 to 30 percent slopes. The Terro soil is on the middle portion of the hillslopes, the Vonalee soil is on the footslopes of hills, and the Taluce soil is on the upper portion of the hillslopes and on the hill crests. 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 Keeline fine sandy loam, Turnercrest fine sandy loam, and sandstone rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Terro soil is moderately deep and well drained. It formed in residuum and eolian deposits derived from sandstone. Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The upper part of the subsoil is pale brown fine sandy loam 25 inches thick. The lower part is light gray fine sandy loam 8 inches thick. Weakly consolidated sandstone is at a depth of 38 inches.

Permeability of the Terro soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Vonalee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper part of the subsoil is pale brown sandy loam 15 inches thick. The lower part, to a depth of 60 inches or more, is light gray fine sandy loam.

Permeability of the Vonalee 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 severe.

The Taluce soil is shallow and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is light yellowish brown fine sandy loam 5 inches thick. The underlying material is light yellowish brown sandy loam 13 inches thick. Weakly consolidated sandstone is at a depth of 18 inches.

Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Terro and Vonalee soils is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range

condition deteriorates, blue grama increases and cheatgrass invades. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, bluebunch wheatgrass, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation and the droughtiness of the Taluce soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock in the Terro and Taluce soils also limits the development of stockwater ponds.

The Terro soil is in capability subclass VIe, nonirrigated. The Vonalee soil is in capability subclass IVe, nonirrigated. The Taluce soil is in capability subclass VIIe, nonirrigated. The Terro and Vonalee soils are in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Terro soil is in windbreak suitability group 6D. The Vonalee soil is in windbreak suitability group 3. The Taluce soil is in windbreak suitability group 10.

## **204—Theedle-Kishona loams, 0 to 6 percent slopes**

This map unit is on alluvial fans and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Theedle loam and 40 percent Kishona 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 Shingle loam, Cushman loam, and Cambria loam. Included

areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Theedle soil is moderately deep and well drained. It formed in residuum and alluvium derived from various sources. Typically, the surface layer is light brownish gray loam 8 inches thick. The underlying material is pale brown loam 20 inches thick. Weakly consolidated shale is at a depth of 28 inches.

Permeability of the Theedle 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 moderate.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light brownish gray loam about 7 inches thick. The underlying material, to a depth of 60 inches, is pale brown loam.

Permeability of the Kishona 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. The potential plant community produces 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. Production of vegetation suitable for livestock grazing is limited by the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

The Theedle soil is poorly suited for stockwater ponds due to the depth to bedrock. The Kishona soil is well suited for stockwater ponds. This unit is well suited for mechanical range renovation and reseeding. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Theedle soil is in windbreak suitability group 6DK. The Kishona soil is in windbreak suitability group 8.

## **205—Theedle-Kishona loams, 6 to 15 percent slopes**

This map unit is on footslopes of hills and in dissected drainageways. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Theedle loam on upper slopes and 40 percent Kishona loam on lower slopes. 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 Shingle loam, Cushman loam, and Cambria loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Theedle soil is moderately deep and well drained. It formed in residuum and alluvium derived from various sources. Typically, the surface layer is light brownish gray loam 8 inches thick. The underlying material is pale brown loam 20 inches thick. Weakly consolidated shale is at a depth of 28 inches.

Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is light brownish gray loam 7 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Kishona 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. The potential plant community produces 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

The Theedle soil is poorly suited for stockwater ponds due to the depth to bedrock. The Kishona soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. This unit is moderately well suited for mechanical range renovation and reseeding. The main limitation is the hazard of water erosion. The low annual precipitation should also be of concern when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Theedle soil is in windbreak suitability group 6DK. The Kishona soil is in windbreak suitability group 8.

### **206—Theedle-Kishona-Shingle loams, 3 to 20 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly short and mid grasses and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Theedle loam, 20 percent Kishona loam, and 20 percent Shingle 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 Cambria loam, Taluce fine sandy loam, and shale rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Theedle soil is moderately deep and well drained. It formed in residuum and alluvium derived

from various sources. Typically, the surface layer is brown and light yellowish brown loam 6 inches thick. The underlying material is pale brown and light gray loam 26 inches thick. Interbedded weakly consolidated sandstone and shale is at a depth of 32 inches.

Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Kishona soil is very deep and well drained. It formed in alluvium derived from various sources. Typically, the surface layer is brown loam 4 inches thick. The subsoil is very pale brown silty clay loam 20 inches thick. The substratum, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Kishona 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 moderate. The hazard of wind erosion is moderate.

The Shingle soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is pale brown loam 4 inches thick. The underlying material is very pale brown loam 8 inches thick. Weakly consolidated shale is at a depth of 12 inches.

Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Theedle and Kishona soils is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, blue grama, and threadleaf sedge. As the range condition deteriorates, blue grama and threadleaf sedge increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 450 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation and the droughtiness of the Shingle soil. If the range is

overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds. The main limitation is the steepness of slope. The depth to bedrock in the Theedle and Shingle soils is also a limitation. This unit is moderately well suited for mechanical range renovation and range seeding in areas with a slope of 3 to 15 percent and poorly suited in areas with a slope of greater than 15 percent. The main limitation is the hazard of water erosion. The low annual precipitation should also be of concern when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tillage should also be along the contour of the slope.

The Theedle and Kishona soils are in capability subclass VIe, nonirrigated. The Shingle soil is in capability subclass VIIe, nonirrigated. The Theedle and Kishona soils are in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Theedle soil is in windbreak suitability group 6DK. The Kishona soil is in windbreak suitability group 8. The Shingle soil is in windbreak suitability group 10.

### **207—Thirtynine silt loam, 0 to 6 percent slopes**

This very deep, well drained soil is on outwash alluvial fans and remnant terraces. It formed in alluvium derived from siltstone. The native vegetation is mainly short and mid grasses and forbs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Kishona loam and Cambria loam.

Typically, the surface layer is grayish brown silt loam 8 inches thick. The upper part of the subsoil is grayish brown silty clay loam 7 inches thick. The next part is pale brown silty clay loam 9 inches thick. The lower part is very pale brown silty clay loam 14 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown silt loam.

Permeability 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. It is well suited for mechanical range renovation and reseeding. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Thirtynine soil is in windbreak suitability group 3.

### **208—Thirtynine-Kadoka silt loams, 2 to 10 percent slopes**

This map unit is on outwash alluvial fans, terraces, and hills. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Thirtynine silt loam on slopes of 2 to 6 percent and 35 percent Kadoka silt loam on slopes of 2 to 10 percent. 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 Senlar silt loam and Epping silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Thirtynine soil is very deep and well drained. It formed in alluvium derived from siltstone. Typically, the surface layer is grayish brown silt loam 11 inches thick. The upper part of the subsoil is pale brown silty clay loam 13 inches thick. The lower part is pink silt loam 15 inches thick. The substratum, to a depth of 60 inches or more, is light brown silt loam.

Permeability of the Thirtynine 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 Kadoka soil is moderately deep and well drained. It formed in alluvium and residuum derived from siltstone. Typically, the surface layer is grayish brown silt loam 7 inches thick. The upper part of the subsoil is light yellowish brown silty clay loam 7 inches thick. The lower part is light brown silt loam 18 inches thick. Weakly consolidated siltstone is at a depth of 32 inches.

Permeability of the Kadoka soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Thirtynine soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. The Kadoka soil is poorly suited for stockwater ponds due to the depth to bedrock. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The low annual precipitation should also be of concern when reseeding. To reduce the hazard of water erosion during reseeding, adequate residue must be maintained on the surface at all times until

the seeding is established. Tillage should also be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated. It is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Thirtynine soil is in windbreak suitability group 3. The Kadoka soil is in windbreak suitability group 6D.

### **209—Threetop-Sunup complex, 3 to 15 percent slopes**

This map unit is on hillslopes and ridges. The native vegetation is mainly grasses, forbs, and shrubs. Elevation is 4,000 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 50 percent Threetop loam on slopes of 3 to 12 percent and 30 percent Sunup channery loam on slopes of 5 to 15 percent. 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 sandstone rock outcrop, shallow loamy soils, and moderately deep clayey soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Threetop soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown loam 3 inches thick. The upper part of the subsoil is brown clay loam 4 inches thick. The next part is pale brown loam 4 inches thick. The lower part is very pale brown loam 17 inches thick. Hard sandstone is at a depth of 28 inches.

Permeability of the Threetop soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

The Sunup soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is light brownish gray channery loam 2 inches thick. The underlying material is pale brown very channery loam 8 inches thick. Hard sandstone is at a depth of 10 inches.

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

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Threetop soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, blue grama and big sagebrush increase. 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 potential plant community on the Sunup soil is mainly needleandthread, prairie sandreed, and little bluestem. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,300 pounds in favorable years to 600 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by the droughtiness of the Sunup soil and the low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the depth to bedrock. The Threetop soil is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. The Sunup soil is poorly suited for mechanical range renovation and range seeding. The main limitations are the rock fragments in the soil and droughtiness. To reduce the hazard of wind erosion if the Threetop soil is seeded, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

The Threetop soil is in capability subclass IVe, nonirrigated. The Sunup soil is in capability subclass VIIe, nonirrigated. The Threetop soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Sunup soil is in the Shallow Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Threetop soil is in windbreak suitability group 6D. The Sunup soil is in windbreak suitability group 10.

### **210—Torrington-Julesburg very fine sandy loams, 0 to 6 percent slopes**

This map unit is on terraces. The native vegetation is mainly short and mid grasses, forbs, and few shrubs. Elevation is 4,900 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average

annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 55 percent Torrington very fine sandy loam and 30 percent Julesburg very 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 Phiferon fine sandy loam, Jayem fine sandy loam, and Trelona fine sandy loam. Included areas make up 15 percent of the total acreage. The percentage varies from one area to another.

The Torrington soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark brown very fine sandy loam 5 inches thick. The subsoil is brown very fine sandy loam 14 inches thick. The substratum is pale brown loamy very fine sand 10 inches thick. Weakly consolidated sandstone is at a depth of 29 inches.

Permeability of the Torrington soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

The Julesburg soil is very deep and well drained. It formed in eolian deposits and residuum derived from sandstone. Typically, the upper part of the surface layer is brown very fine sandy loam 4 inches thick. The lower part is grayish brown very fine sandy loam 8 inches thick. The subsoil is brown fine sandy loam 26 inches thick. The substratum, to a depth of 60 inches or more, is pale brown loamy fine sand.

Permeability of the Julesburg soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for livestock grazing and wildlife habitat. A few areas are used for cropland.

The potential plant community on this unit is mainly needleandthread, thickspike wheatgrass, little bluestem, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion

of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Torrington soil is also a limitation to the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

If this unit is used for nonirrigated cropland, the main limitation is the hazard of wind erosion. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Tillage should be kept to a minimum. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the droughtiness of the soils and the hazard of wind erosion. Frequent applications of irrigation water will be necessary because of the droughtiness of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs. Maintaining crop residue on or near the surface reduces wind erosion.

The Torrington soil is in capability subclass IIIe, irrigated, and IVe, nonirrigated. The Julesburg soil is in capability subclass IIIe, irrigated and nonirrigated. This map unit is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Torrington soil is in windbreak suitability group 6D. The Julesburg soil is in windbreak suitability group 5.

### **211—Torriorthents, very steep**

These shallow and moderately deep, well drained soils are on escarpments and hillslopes. Slope ranges from 20 to 80 percent. They formed in colluvium and residuum derived from various sources. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of very deep soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

No single profile of these soils is typical, but commonly the surface layer is pale brown channery loam or channery clay loam 1 to 3 inches thick. The underlying material is commonly light brownish gray loam or clay loam 9 to 39 inches thick. Depth to weakly consolidated sandstone or shale is 10 to 40 inches.

Permeability is moderate to slow. The available water capacity is very low to moderate. Effective rooting depth is 10 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This map unit is used for wildlife habitat and limited livestock grazing.

The vegetation on this unit is mainly ponderosa pine with an understory of bluebunch wheatgrass, needleandthread, prairie sandreed, and little bluestem. Production of vegetation suitable for livestock grazing is limited by the droughtiness of the soils, the tree canopy cover, and the low annual precipitation.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in the Grazeable Woodland site, 10- to 14-inch precipitation, Northern Plains zone. This soil is in windbreak suitability group 10.

### **212—Trelona-Phiferson-Vetal fine sandy loams, 6 to 30 percent slopes**

This map unit is on hillslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,400 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 35 percent Trelona fine sandy loam on slopes of 6 to 30 percent, 30 percent Phiferson fine sandy loam on slopes of 6 to 20 percent, and 20 percent Vetal fine sandy loam on slopes of 6 to 9 percent. 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 Jayem fine sandy loam and sandstone rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Trelona soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 7 inches thick. The underlying material is brown fine sandy loam 7 inches thick. Weakly consolidated sandstone is at a depth of 14 inches.

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

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is dark brown fine sandy loam 5 inches thick. The upper part of the subsoil is brown fine sandy loam 15 inches thick. The lower part is light gray loamy very fine sand 11 inches thick. Weakly consolidated sandstone is at a depth of 31 inches.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

The Vetal soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is brown fine sandy loam 16 inches thick. The subsoil is brown fine sandy loam 8 inches thick. The substratum to a depth of 60 inches is light brownish gray fine sandy loam.

Permeability of the 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Trelona soil is mainly little bluestem, needleandthread, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and blue grama increase. 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 vegetation suitable for livestock grazing is limited by the droughtiness of the soil.

The potential plant community on the Phiferson and Vetal soils are mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, blue grama and threadleaf sedge increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are the depth to bedrock and steepness of slope of the Trelona and Phiferson soils and the potential for seepage losses in the Vetal soil. The Trelona and Phiferson soils are poorly suited for mechanical range renovation and range seeding due to the steepness of slope. The Vetal soil is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion when range seeding the Vetal soil adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

The Trelona soil is in capability subclass VIIe, nonirrigated. The Phiferson soil is in capability subclass VIe, nonirrigated. The Vetal soil is in capability subclass IVe, nonirrigated. The Trelona soil is in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site precipitation zone. The Phiferson and Vetal soils are in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Trelona soil is in windbreak suitability group 10. The Phiferson soil is in windbreak suitability group 6D. The Vetal soil is in windbreak suitability group 3.

## 213—Ulm clay loam, 0 to 6 percent slopes

This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from shale. The native vegetation is mainly grasses and shrubs. Elevation is 3,800 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Forkwood loam and Cushman loam.

Typically, the surface layer is dark brown clay loam 3 inches thick. The upper 12 inches of the subsoil is brown clay loam. The lower part of the subsoil, to a depth of 60 inches or more, is grayish brown clay loam.

Permeability is moderately slow. 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 for rangeland and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be of concern when reseeding.

This map unit is in capability subclass IVe, nonirrigated. It is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Ulm soil is in windbreak suitability group 4C.

## **214—Ulm-Bidman loams, 0 to 6 percent slopes**

This map unit is on alluvial fans. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 45 percent Ulm loam and 40 percent Bidman 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 Cambria loam and Cushman loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ulm soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 5 inches thick. The upper part of the subsoil is brown clay loam

4 inches thick. The next part is grayish brown clay 15 inches thick. The lower part, to a depth of 60 inches or more, is pale brown clay loam.

Permeability of the Ulm soil is moderately slow. 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 Bidman soil is deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is light brownish gray and pale brown loam 3 inches thick. The upper part of the subsoil is light brownish gray clay 13 inches thick. The next part is light brownish gray clay loam 28 inches thick. The lower part, to a depth of 60 inches or more, is light brownish gray clay loam.

Permeability of the Bidman soil is slow. Available water capacity is high. Effective rooting depth is to 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 for rangeland and wildlife habitat.

The potential plant community on the Ulm soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Bidman soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. The Ulm soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Bidman soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Ulm and Bidman soils are in windbreak suitability group 4C.

### **215—Ulm-Forkwood loams, 0 to 6 percent slopes.**

This map unit is on alluvial fans. The native vegetation is mainly short and mid grasses, forbs, and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is 45 percent Ulm loam and 40 percent Forkwood 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 Cambria loam and Cushman loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ulm soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 5 inches thick. The upper part of the subsoil is brown clay loam 4 inches thick. The next part is grayish brown clay 15 inches thick. The lower part, to a depth of 60 inches or more, is pale brown clay loam.

Permeability of the Ulm soil is moderately slow. 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 Forkwood soil is very deep and well drained. It formed in alluvium derived from sedimentary rocks. Typically, the surface layer is brown loam 3 inches thick. The upper part of the subsoil is brown clay loam 15 inches thick. The next part is pale brown clay loam 5 inches thick. The lower part, to a depth of 60 inches or more, is pale brown loam.

Permeability of the Forkwood 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.

This unit is used for rangeland and wildlife habitat.

The potential plant community on the Ulm soil is mainly western wheatgrass, green needlegrass, and blue grama. As the range condition deteriorates, big

sagebrush and blue grama increase. The potential plant community produces about 1,000 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 600 pounds in unfavorable years.

The potential plant community on the Forkwood soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. As the range condition deteriorates, big sagebrush and blue grama increase. 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 750 pounds in unfavorable years.

The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The Ulm soil is well suited for stockwater ponds. The Forkwood soil is moderately well suited for stockwater ponds with the moderate potential for seepage losses being the main limitation. This unit is well suited for mechanical range renovation and range seeding. The low annual precipitation should be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind.

This map unit is in capability subclass IVe, nonirrigated. The Ulm soil is in the Clayey, 10- to 14-inch precipitation, Northern Plains range site. The Forkwood soil is in the Loamy, 10- to 14-inch precipitation, Northern Plains range site. The Ulm soil is in windbreak suitability group 4C. The Forkwood soil is in windbreak suitability group 3.

### **216—Ustic Torriorthents, gullied, 3 to 45 percent slopes**

These shallow and moderately deep, well drained soils are on hillsides dissected by numerous drainageways. They formed in alluvium and residuum derived from various sources. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of very deep, frequently flooded soils in the drainageways. Included areas make up about 10 percent of the

total acreage. The percentage varies from one area to another.

No single profile of these soils is typical, but commonly the surface layer is pale brown loam or clay loam 1 to 3 inches thick. The underlying material is commonly light brownish gray loam or clay loam 9 to 39 inches thick. Depth to weakly consolidated shale is 10 to 40 inches.

Permeability is moderate to slow. The available water capacity is very low to moderate. Effective rooting depth is 10 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This map unit is used for wildlife habitat and limited livestock grazing.

The vegetation on this unit is sparse in most areas and is mainly grasses and forbs. Production of vegetation suitable for livestock grazing is limited by the droughtiness of the soils and the low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope. The depth to bedrock also limits the development of stockwater ponds.

This map unit is in capability subclass VIIe, nonirrigated. It is in windbreak suitability group 10.

### **217—Ustic Torriorthents, cool-Torriorthentic Haplustolls-Rock outcrop complex, 6 to 60 percent slopes**

This map unit is on ridges and hillsides. The native vegetation is mainly grasses, shrubs, and ponderosa pine. Elevation is 4,500 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost free period is 110 to 130 days.

This unit is 35 percent Ustic Torriorthents soils; 35 percent Torriorthentic Haplustolls soils; 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 moderately deep and deep sandy soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ustic Torriorthents soil is shallow to very deep and well drained or somewhat excessively drained. It formed in residuum and alluvium derived from sandstone. No single profile is typical, but commonly the surface layer is pale brown sandy loam or loam 1 to 3 inches thick. The underlying material is light brownish gray sandy loam or loam 9 to 59 inches or more thick. Depth to weakly consolidated sandstone bedrock ranges from 10 to 60 inches or more.

Permeability of the Ustic Torriorthents soil is moderately rapid or moderate. Available water capacity is very low to high. Effective rooting depth is 10 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

The Torriorthentic Haplustolls soil is shallow or moderately deep and well drained or somewhat excessively drained. It formed in alluvium and eolian deposits derived from sandstone. No single profile is typical, but commonly the surface layer is dark grayish brown fine sandy loam or loam 7 to 10 inches thick. The underlying material is grayish brown fine sandy loam or loam 3 to 33 inches thick. Depth to sandstone bedrock ranges from 10 to 40 inches.

Permeability of the Torriorthentic Haplustolls soil is moderately rapid or moderate. Available water capacity is very low to moderate. Effective rooting depth is 10 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion is severe.

Rock outcrop consists of areas of exposed sandstone.

This unit is used for rangeland or wildlife habitat.

The present plant community on the Ustic Torriorthents soil is mainly ponderosa pine with an understory of grasses and forbs.

The potential plant community on the Torriorthentic Haplustolls soil is mainly needleandthread, little bluestem, western wheatgrass, and Indian ricegrass. As the range condition deteriorates, threadleaf sedge and fringed sagewort increase. 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 vegetation suitable for livestock grazing is limited by droughtiness of the soils and the tree canopy cover on the Ustic Torriorthents soil.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding due to the steepness of slope.

The Ustic Torriorthents and Torriorthentic Haplustoll soils are in capability subclass VIIe, nonirrigated. Rock outcrop is in capability class VIII. The Ustic

Torriorthents soils are in Ponderosa Pine Grazeable Woodland site. The Torriorthentic Haplustolls soils are in the Shallow Sandy, 15- to 17-inch precipitation, Southern Plains range site. These soils are in windbreak suitability group 10.

### **218—Vetal fine sandy loam, 0 to 3 percent slopes**

This very deep, well drained soil is on alluvial fans and toeslopes of hills. It formed in alluvium and eolian deposits derived from sandstone. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost free period is 110 to 130 days.

Included in this unit are small areas of Jayem fine sandy loam.

Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The upper part of the subsoil is grayish brown fine sandy loam 19 inches thick. The lower part is brown fine sandy loam 11 inches thick. The substratum, to a depth of 60 inches or more, is grayish brown fine sandy loam.

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

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, little bluestem and blue grama increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on

the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soil. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soil. Maintaining crop residue on or near the surface reduces wind erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Vetal soil is in windbreak suitability group 3.

### **219—Vetal fine sandy loam, 3 to 9 percent slopes**

This very deep and well drained soil is on footslopes of hills. It formed in alluvium and eolian deposits derived from sandstone. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Phiferon fine sandy loam, Trelona fine sandy loam, Jayem fine sandy loam, and Busher fine sandy loam.

Typically, the surface layer is dark brown fine sandy loam 30 inches thick. The underlying material, to a depth of 60 inches or more, is dark grayish brown fine sandy loam.

Permeability 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 moderate. The hazard of wind erosion is severe.

This unit is used for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, prairie sandreed, and thickspike wheatgrass. As the range condition deteriorates, little bluestem and blue grama increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soil. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion, steepness of slope, and droughtiness of the soil. Maintaining crop residue on or near the surface reduces wind erosion. Because of the steepness of slope, sprinkler irrigation is the best method. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Vetala soil is in windbreak suitability group 3.

## **220—Vetala-Phiferon fine sandy loams, 0 to 6 percent slopes**

This map unit is on alluvial fans and valley sideslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 45 percent Vetala fine sandy loam and 35 percent Phiferon 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 Jayem fine sandy loam and Busher fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Vetala soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam 17 inches thick. The subsoil is grayish brown fine sandy loam 15 inches thick. The substratum, to a depth of 60 inches or more, is brown very fine sandy loam.

Permeability of the Vetala 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 severe.

The Phiferon soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 6 inches thick. The upper part of the subsoil is brown and pale brown fine sandy loam 19 inches thick. The lower part is pale brown loamy very fine sand 8 inches thick. Weakly consolidated sandstone is at a depth of 33 inches.

Permeability of the Phiferon soil is moderately rapid. Available water capacity is low. 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 severe.

This unit is used mainly for rangeland, cropland, and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, threadleaf sedge, blue grama, and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses in both soils and the depth to bedrock in the Phiferson soil. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

If this unit is used for nonirrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soils. Tillage should be kept to a minimum. Maintaining crop residue on or near the surface reduces wind erosion. Stripcropping also helps to control wind erosion. Because precipitation is not sufficient for annual cropping, a rotation of small grain and summer fallow is most suitable.

If this unit is used for irrigated cropland, the main limitations are the hazard of wind erosion and droughtiness of the soils. Maintaining crop residue on or near the surface reduces wind erosion. Frequent applications of irrigation water will be necessary because of the limited available water capacity of the soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity of the soil and the crop needs.

The Vetal soil is in capability subclass IIIe, irrigated and nonirrigated. The Phiferson soil is in capability subclass IVe, irrigated and nonirrigated. The map unit is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Vetal soil is in windbreak suitability group 3. The Phiferson soil is in windbreak suitability group 6D.

### **221—Vetal-Phiferson fine sandy loams, 6 to 15 percent slopes**

This map unit is on alluvial fans and valley sideslopes. The native vegetation is mainly grasses and shrubs. Elevation is 4,800 to 5,500 feet. The average annual precipitation is 15 to 17 inches, the

average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Vetal fine sandy loam on slopes of 6 to 9 percent and 40 percent Phiferson fine sandy loam on slopes of 6 to 15 percent. 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 Jayem, Busher, and Trelona fine sandy loams. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Vetal soil is very deep and well drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is brown fine sandy loam 16 inches thick. The subsoil is brown fine sandy loam 8 inches thick. The substratum, to a depth of 60 inches or more, is light brownish gray fine sandy loam.

Permeability of the 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 moderate. The hazard of wind erosion is severe.

The Phiferson soil is moderately deep and well drained. It formed in residuum derived from sandstone. Typically, the surface layer is grayish brown fine sandy loam 8 inches thick. The upper part of the subsoil is brown fine sandy loam 15 inches thick. The lower part is light brownish gray fine sandy loam 7 inches thick. Weakly consolidated sandstone is at a depth of 30 inches.

Permeability of the Phiferson soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, little bluestem, thickspike wheatgrass, and prairie sandreed. As the range condition deteriorates, threadleaf sedge, blue grama, and silver sagebrush increase. 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.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. The depth to bedrock in the Phiferson soil also limits the development of stockwater ponds. This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layers.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 15- to 17-inch precipitation, Southern Plains range site. The Vetol soil is in windbreak suitability group 3. The Phiferson soil is in windbreak suitability group 6D.

### **222—Vonalee sandy loam, 0 to 6 percent slopes**

This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from sandstone. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

Included in this unit are small areas of Terro sandy loam and Hiland sandy loam.

Typically, the surface layer is light brownish gray sandy loam 3 inches thick. The upper part of the subsoil is grayish brown and pale brown fine sandy loam 29 inches thick. The lower part, to a depth of 60 inches or more, is pale brown and very pale brown loamy fine sand.

Permeability is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama increases and cheatgrass invades. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This soil is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Vonalee soil is in windbreak suitability group 5.

### **223—Vonalee-Keeline fine sandy loams, 2 to 10 percent slopes**

This map unit is on alluvial fans and footslopes of hills. The native vegetation is mainly grasses and shrubs. Elevation is 3,600 to 4,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 46 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is 40 percent Vonalee fine sandy loam and 35 percent Keeline 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 Turnercrest fine sandy loam, Hiland fine sandy loam, and Taluce fine sandy loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Vonalee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is brown fine sandy loam 4 inches thick. The upper part of the subsoil is brown fine sandy loam 13 inches thick. The lower part, to a depth of 60 inches or more, is pale brown fine sandy loam.

Permeability of the Vonalee 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 severe.

The Keeline soil is very deep and well drained. It formed in alluvium and eolian deposits derived from various sources. Typically, the surface layer is brown fine sandy loam 2 inches thick. The upper part of the underlying material is brown and pale brown fine sandy loam 36 inches thick. The lower part, to a depth of 60 inches or more, is yellowish brown fine sandy loam.

Permeability of the Keeline 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 severe.

This unit is used for rangeland and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. As the range condition deteriorates, blue grama increases and cheatgrass invades. The potential plant community produces about 1,300 pounds of air-dry vegetation per acre in normal years. Production varies from 1,600 pounds in favorable years to 750 pounds in unfavorable years. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

This unit is poorly suited for stockwater ponds due to the potential for seepage losses. It is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of wind erosion. The low annual precipitation should also be of concern when reseeding. To reduce the hazard of wind erosion during reseeding, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

This map unit is in capability subclass IVe, nonirrigated. It is in the Sandy, 10- to 14-inch precipitation, Northern Plains range site. The Keeline soil is in windbreak suitability group 8. The Vonalee soil is in windbreak suitability group 3.