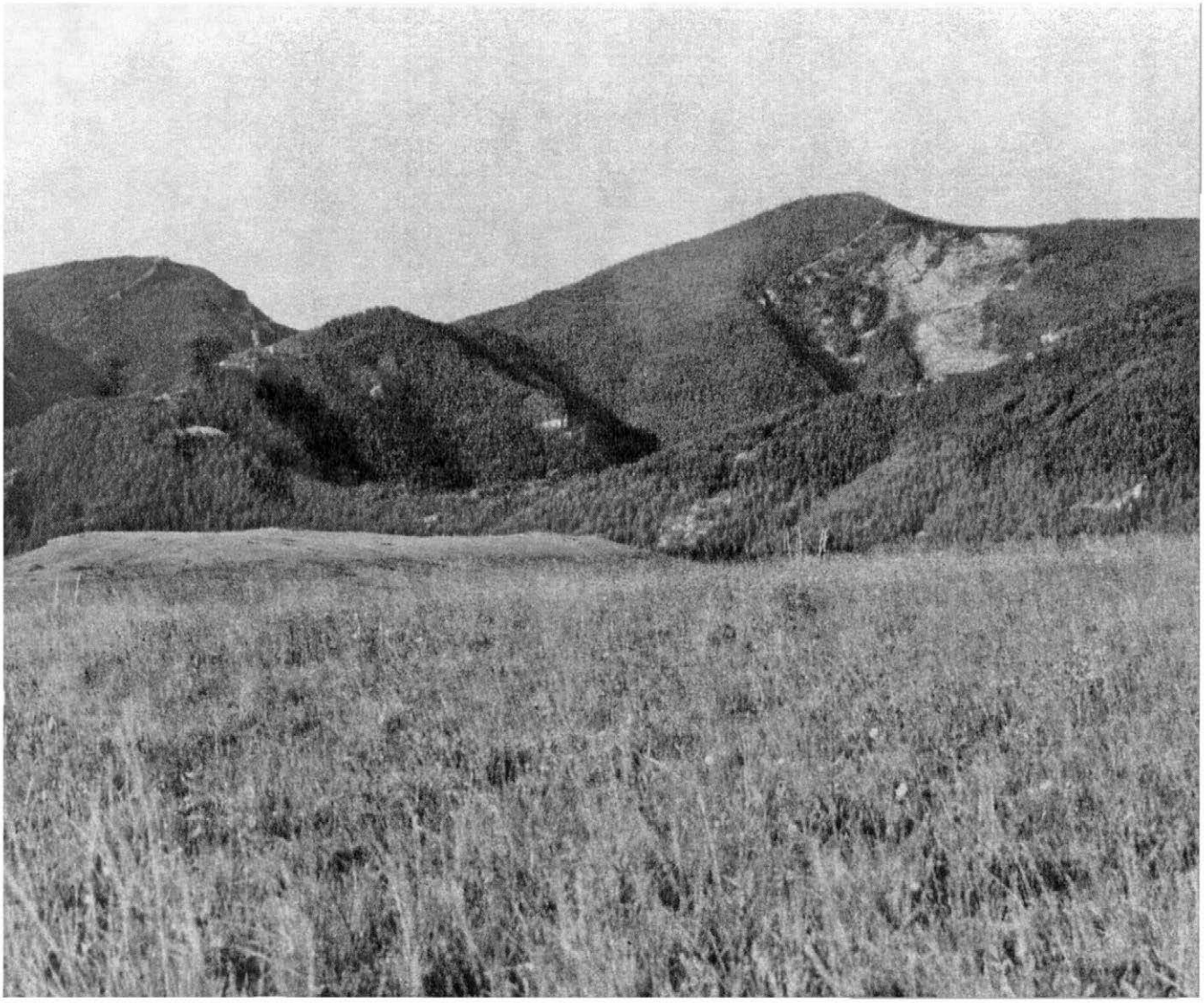
United States Department of Agriculture

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 Sheridan County Area, 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.

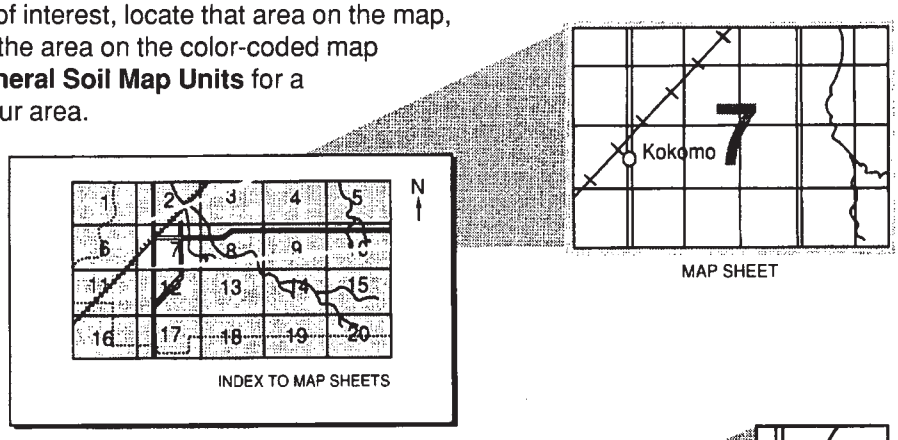
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

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.



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

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

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

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Natural Resources Conservation Service and the University of Wyoming, Agricultural Experiment Station. This survey is part of the technical assistance furnished to the Clearwater Conservation District.

Cover: An area of the Trimad-Trivar-Abac general soil map unit in the Sheridan County Area. An area of the Tolman-Cloud Peak-Starley general soil map unit is in the background.

Contents

Issued 1998

Index to Soil Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Sheridan County Area, 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, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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
Sheridan County Area, Wyoming

By Paul Lupcho
Fieldwork by Brad Gilbert, James R. Stephens, Jr., Scott Fisher, John Werlein, Jim Jurosek, Dan Kowalski, Douglas Barker, Roger Hopper, Jim Pahl, John E. Iiams, John MacDonald, and Paul Lupcho, Natural Resources Conservation Service

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

General Nature of the Survey Area

Sheridan County Area is in north-central Wyoming along the eastern slope of the Big Horn Mountains and eastward into the Powder River Basin (fig. 1). Sheridan County is about 1,598,195 acres, or 2,497 square miles, of which about 1,225,278 acres are in the survey area. The rest of the county is in the Big Horn National Forest. About 86 percent of the survey area is privately owned land, 10 percent is state and county owned, and 4 percent is federally owned and managed by the Bureau of Land Management.

In 1985, the population of Sheridan County was estimated to be 26,275. Sheridan, the county seat, had a population of 17,545. Other towns in the survey area are Arvada, Big Horn, Clearmont, Dayton, Ranchester, and Story.

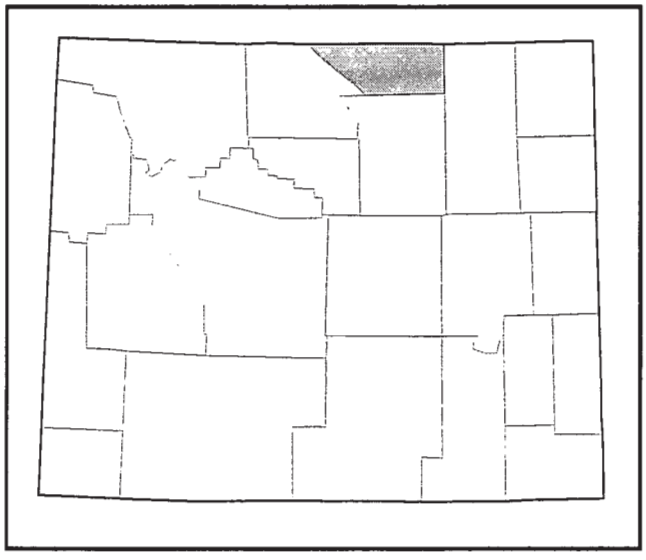


Figure 1.—Location of Sheridan County Area in Wyoming.

An earlier survey, "Soil Survey of Sheridan County, Wyoming," was published in 1939. This survey covers a part of the present survey area. The present survey updates the earlier survey and provides additional information and larger scale maps that show the soils in greater detail.

History

The Sheridan County Area was originally inhabited by the Crow, Cheyenne, and Sioux tribes. The United States Government acquired northern Wyoming as part of the Louisiana Purchase in 1803. Europeans seldom trespassed this area until pioneers and settlers established the Bozeman Trail in 1863. This route threatened Indian control of the area and the inevitable conflicts resulted. Several battles between the Indians and U.S. troops in the area between 1865 and 1867 often resulted in the defeat of the U.S. troops, such as the Fetterman Massacre near present-day Banner, where 82 soldiers from nearby Fort Phil Kearny were killed. In 1868, treaties were negotiated that were favorable to the Indians and that again guaranteed them control over their lands; however, these treaties proved to be ineffective. In 1876, resistance by the Indians climaxed in their victory at the Battle of the Little Big Horn 70 miles north of Sheridan in southern Montana. As a result, the United States Government increased military pressure to force the Indians onto reservations.

By the late 1870's, most of the Indians had been subjugated, and the way was clear for immigration into

and settlement of the area. Migrations of settlers took advantage of the Homestead Acts and started moving into the area in the 1880's and 1890's. These early settlers were mainly small farmers and livestock raisers who produced meat, grain, and vegetables. Also, large cattle companies had formed and had their headquarters near the base of the mountains. Often, these early ranches were associated with eastern or English land and cattle companies. Irrigated farming began about this time as cattleman began to raise hay on bottom lands, while farmers raised wheat, oats, and barley. By 1900, much of the best land was irrigated by an adequate supply of water and put into production.

In 1892, the first commercial coal mine was opened north of Sheridan. Commercial mining of coal was precipitated and encouraged by the extension of the railroad into Sheridan, which also occurred in 1892. The early mines were underground operations that required much manpower. The spread of coal mining in the early 1900's attracted many people, including many immigrants from eastern and southern Europe. During the first quarter of the 20th century, many of the existing buildings in the older part of downtown Sheridan were built. Sheridan County experienced a second period of growth in the early 1970's, when large strip mines were opened across the state line near Decker, Montana. The local economy of Sheridan County was still heavily based on agriculture and mining into the 1980's.

Water Supply

Almost all of the water used for domestic purposes in the Sheridan County Area has its source as snowmelt in the Big Horn Mountains. The perennial streams that cross the survey area are a major source of irrigation water by way of canals and ditches. Some irrigation water also is derived from underground sources.

The major streams draining the area are the Tongue, Powder, and Little Big Horn Rivers and their tributaries. They ultimately join the Yellowstone River and consequently become part of the Missouri River system. The use of surface water is controlled by the Yellowstone River Compact (1950), which governs how the waters of the Yellowstone River are divided. Although the Tongue and Powder Rivers normally have unappropriated and unused waters available for division, no Compact water is available during drought years.

Streamflow is mainly from precipitation in the Big Horn Mountains and is highest during runoff in May and June. Streams draining the basin areas generally have low flows the rest of the year.

The primary use of water in the survey area is for irrigation. Water for the use of livestock is second. Municipal water supplies for the towns of Sheridan, Dayton, and Ranchester account for the third major use.

The chemical quality of the ground water depends on the geochemistry of the aquifer from which it is drawn. Waters suitable for domestic or livestock use can be obtained from the Lance Formation, Bearpaw Shale, Parkman Sandstone, and Tensleep Sandstone. Good-quality waters for irrigation can be obtained from the Tensleep, Amsden, and Flathead Formations *(Hodson, 1973)*.

Water for domestic use from the Fort Union Formation may have a high content of iron and total dissolved solids. While Fort Union water may be suitable for livestock, its high contents of sodium and bicarbonate make it unsuited to irrigation. Water for domestic use from the Wasatch Formation generally exceeds the standard for total dissolved solids. Water from the Wasatch Formation varies in suitability for agricultural use. Both of these major Tertiary aquifers can contain objectionable levels of hydrogen sulfide. The most common water types in the Sheridan County Area are sulfate and bicarbonate waters, with calcium and sodium the dominant cations.

Most livestock and domestic wells are developed in the Tertiary Fort Union and Wasatch Formations. These wells are relatively shallow and do not produce large quantities of water. Quaternary deposits along the major streams provide good supplies of unconfined water.

Most of the major recharge areas are west of the survey area in the Big Horn Mountains, where precipitation infiltrates areas of rock outcrop. The foothills belt of the mountains in the survey area contains several good aquifers. However, these rocks dip steeply into the Powder River Basin and are deeply buried within a few miles of their outcrops. Seventy-five percent of the county is in the Powder River Basin, which is underlain by Tertiary sediments that contain lenticular aquifers of moderate ground water potential *(Lowry, 1966)*.

Industry, Transportation, and Recreation

Industry

Coal mining is the leading industry in the Sheridan County Area, employing about 1,000 persons.

Although three of the four large mines in or near the area are in southern Montana, most employees live in Sheridan County. The Veteran's Administration hospital has been a major employer in Sheridan since the 1920's. Built on the site of Fort Mackenzie, a former cavalry post, the V.A. employs about 500 persons. Another large employer is the Burlington Northern Railroad. Although the maintenance shops have been closed, the railroad still employs about 300 people. Other industries are oil and gas field maintenance in the Ash Creek and Fence Creek drainageways, timber processing, and sand and gravel mining.

Transportation

The main highways serving the Sheridan County Area are Interstate Highway 90 and U.S. Highways 87, 14, and 16. Several parcel and freight trucking companies have depots in Sheridan. Railroad freight service is also available. Commercial and charter air service is available at Sheridan Municipal Airport, which is a designated Flight Service Station (FSS). The airport has two all-weather runways, the longest of which is 6,650 feet. An office of the National Weather Service is at the airport.

Recreation

Recreation in the area centers on the Big Horn Mountains. U.S. Highway 14 provides through access to the Big Horn National Forest, where wilderness areas as well as developed recreational sites are available. Two reservoirs, Lake DeSmet and Tongue River Reservoir, which are also popular recreational sites, are close to the survey area.

Agriculture

Agriculture represents a major source of income for the Sheridan County Area. Livestock ranching, both cattle and sheep, dominates the agricultural economy. Of the more than 90,000 acres of irrigated cropland in the county, about 92 percent, or 85,000 acres, is used as hayland. The rest of the irrigated acreage is used for barley, oats, and corn. About 33,000 acres of cropland is nonirrigated, of which about 50 percent is used for hay and pasture. Winter wheat and barley account for most of the rest of the acreage of nonirrigated cropland. Timber harvesting is also important to the local economy. It occurs in the Big Horn National Forest outside the survey area. Several dairy farms are in the county.

Physiography and Geology

Dr. Robert Palmquist, geologist, Northwest Community College, Powell, Wyoming, helped prepare this section.

The Sheridan County Area is dominated by two major structural features, the Powder River Basin and the Big Horn Mountains. The Powder River Basin, part of the Missouri Plateau section of the Great Plains, is a structural trough with its deepest part lying just east of and parallel to the Big Horn Mountains. The Big Horn Mountains, most of which lie outside of the survey area, are in the lower part of the Middle Rockies. The survey area has been subject to frequent tectonic activity, but Cenozoic tectonism during the last 65 million years is responsible for most of the present large-scale structural features. Generally, the formations in the survey area tend to decrease with age in an easterly direction.

Outcrops of Cretaceous formations are common along the steep flanks of the Big Horn Mountains. Associated with these outcrops are such soils as Cloud Peak and Tolman soils. Outcrops of the Fox Hills and Lance Formation sandstones, which produce such soils as Assinniboine and Reeder soils, are in an eastward swath extending from Parkman to northwest of Story. Tertiary age material overlain by Pleistocene glacial outwash generally begins on the high terraces west of Sheridan and Ranchester in the Fort Union Formation. Most of the coal beds in the survey area are in this formation. Typical soils in this area are Bidman, Platsher, and Big Horn soils. The Wasatch Formation is dominant in an area east of the Little Goose and Tongue River drainages and extending to the Powder River drainage. Wyarno, Cambria, and Ulm soils generally are in this area.

The landscape in the western part of the survey area is characterized by steep dip slopes and narrow, deep drainageways. The dip slopes parallel the mountain flanks in a north-south direction, while the streams generally dissect the slopes and flow out of the mountains in an easterly direction. Such soils as Beeno and Lucky soils are on these slopes.

The topography consists of a series of relatively flat terraces and rolling hills eastward from the mountain flanks for 10 to 15 miles into the Prairie Dog Creek and Big Goose Creek drainages. These terraces are dissected by stream valleys that are generally less than half a mile wide. The deposits of terraces are mainly outwash gravels and cobbles from late Pleistocene glacial meltwaters. These deposits

have been buried by more recent alluvial and eolian material derived from sedimentary rock *(Sheridan Cty. Res. No. 5, 1978)*. Soils that have gravel in their substratum, such as Platsher and Wolfvar soils, are common in this area, as are such nongravelly soils as Nuncho and Recluse soils.

East of these terraces lies the western flank of the Great Plains. This area is a highly dissected plateau that is interspersed with nearly level alluvial valleys. The valleys generally range from one-half to one mile wide and are extensively cultivated. The ridges and interstream divides in this area generally rise to a height of less than 300 feet above the bottoms of the valleys. Parmleed, Renohill, Cushman, and Bidman soils are generally on these uplands. Such soils as Zigweid, Kishona, and Ulm soils are common on the terraces in these alluvial valleys.

The Fort Union shale has been subject to severe geologic erosion along the Powder River north of Arvada in the Clear Creek area. This erosion has resulted in broken hills and steep drainageways known as the Powder River Breaks. Shallow soils, such as Shingle, Samday, and Worfka soils, typically occur on these hills.

Also occurring throughout the eastern two-thirds of the survey area are areas of porcellanite outcrop. Porcellanite (also called clinker, scoria, or red shale) is the result of ancient underground fires in coal seams that baked the overlying shale beds, thereby metamorphosing them into their distinctive red color. In areas where these outcrops are contiguous, the landscape consists of rounded, conical-shaped knobs of porcellanite with swales generally less than 200 yards wide. The soils occurring in these swales, such as Wetterdon, Harlan, and Kirtley soils, are almost always dark. Baux, Bauxson, and Wibaux soils occur near the porcellanite outcrop.

Coal Mine Subsidence

Several areas near Sheridan are underlain by abandoned underground mines. Surface subsidence is common in these areas and occurs as depressions and pits, some of which are a hazard to humans, livestock, and wildlife. The depressions occur where much of the coal has been removed and the remaining coal cannot support the weight of the overlying strata, which is made up of weak shales, siltstones, and sandstones (fig. 2). Burning coal seams occasionally occur in these areas and may burn for years. Fires commonly start by spontaneous ignition, when water and air enter the abandoned mine shafts through subsidence cracks and pits. The fires can then spread to the unmined coal, creating more subsidence cracks and pits through which air can circulate *(Dunrud, 1980)*.

In modern mining operations, this potential problem does not exist since all of the land surface underlain by minable coal is removed in order to expose the coal seams. After the coal is removed, the overburden and topsoil are replaced and the land is regraded and revegetated.

Landslides

Landslides are very common in the Sheridan County Area and range from rockslides in the mountains to debris slides and earthflows in the foothills. In the mountains where stratification or fractures are inclined into a valley, large masses of rock may slide along these surfaces during a wet spring when vibrations from earthquakes have disturbed their equilibrium. Such slides may be extremely rapid, moving many feet per second. Examples are the Buffalo Tongue and Fallen City Slides along U.S. Highway 14 in the Big Horn Mountains. In the hilly areas of the basin, the landslides are typically debris slides or earthflows developed on weathered shales. These failures are most common in areas that receive more than 15 inches of precipitation. Although they occur on all of the slopes, they are dominant on the steep and very steep slopes that have a south- or east-facing aspect. On these slopes, winds from the northwest cause large snowdrifts to form. When the snowdrifts melt in the spring, the soil becomes supersaturated and failure occurs. Most of these failures are slow (inches to feet per year), but some may be rapid (feet per second). Parts of the survey area have a long history of landslides, and most hillslopes that are prone to failure have the scars of one or more active or inactive landslides (fig. 3).

Many of the landslides in the survey area are the result of human activity. Terrace escarpments are very prone to landslides in areas where there is an increase in available moisture. Escarpments below irrigated fields or lawns fail when the excess moisture moves laterally underground along the gravel-shale contact zone to the escarpment, saturates the shales or soils, and results in failure. Springs are common in these areas. These types of failures are common along the north side of State Highway 331 between Sheridan and the Sheridan Municipal Golf Course. Elsewhere, slope failures are possible where irrigation ditches cross the steep slopes on shales and where engineering works oversteepen hillslopes and terrace

escarpments, particularly if a seep or spring is encountered.

The landslide potential of the slopes should always be considered when areas underlain by shales or inclined strata are developed. Some features that aid in the recognition of existing failures are: a hummocky hillslope below a straight to curved scarp; fractures and small scarps in the soil or many loose blocks of rock or soil; seepage zones; unnatural topography, such as spoon-shaped troughs or undrained depressions on the hillslope; an increase in the amount of vegetation, which indicates a higher level of moisture in the soil; and inclined trees and poles, displaced fences, and patched or rough roads. An expert should be consulted for a professional opinion before development begins in these areas.

Climate

The Sheridan County Area has a diverse climate, with considerable differences in temperature and precipitation between the western part in the Big Horn Mountains and the eastern part, which is part of the Powder River Basin. The Big Horn Mountains receive abundant precipitation, about 18 to 30 inches annually, much of which is orographic. The eastern part of the survey area along the Powder River receives only about 12 inches annually. Most of the survey area is in the 15- to 19-inch precipitation zone.

The Big Horn Mountains have a marked effect on the climate of the survey area, especially in the western part. Because Sheridan is near the mountains, its average annual precipitation is more than that in the neighboring areas to the east and north. During the winter, the winds generally shift to the west or southwest and are higher in velocity. These downslope winds, or Chinook winds, are warm and often persist for several days. The Chinook winds are very effective in moderating the severity of the winter climate in this area. In the summer,

Figure 2.—An area of subsidence near Monarch. These pits can occur where underground coal mining has left insufficient material to support the overlying strata, resulting in its eventual collapse.

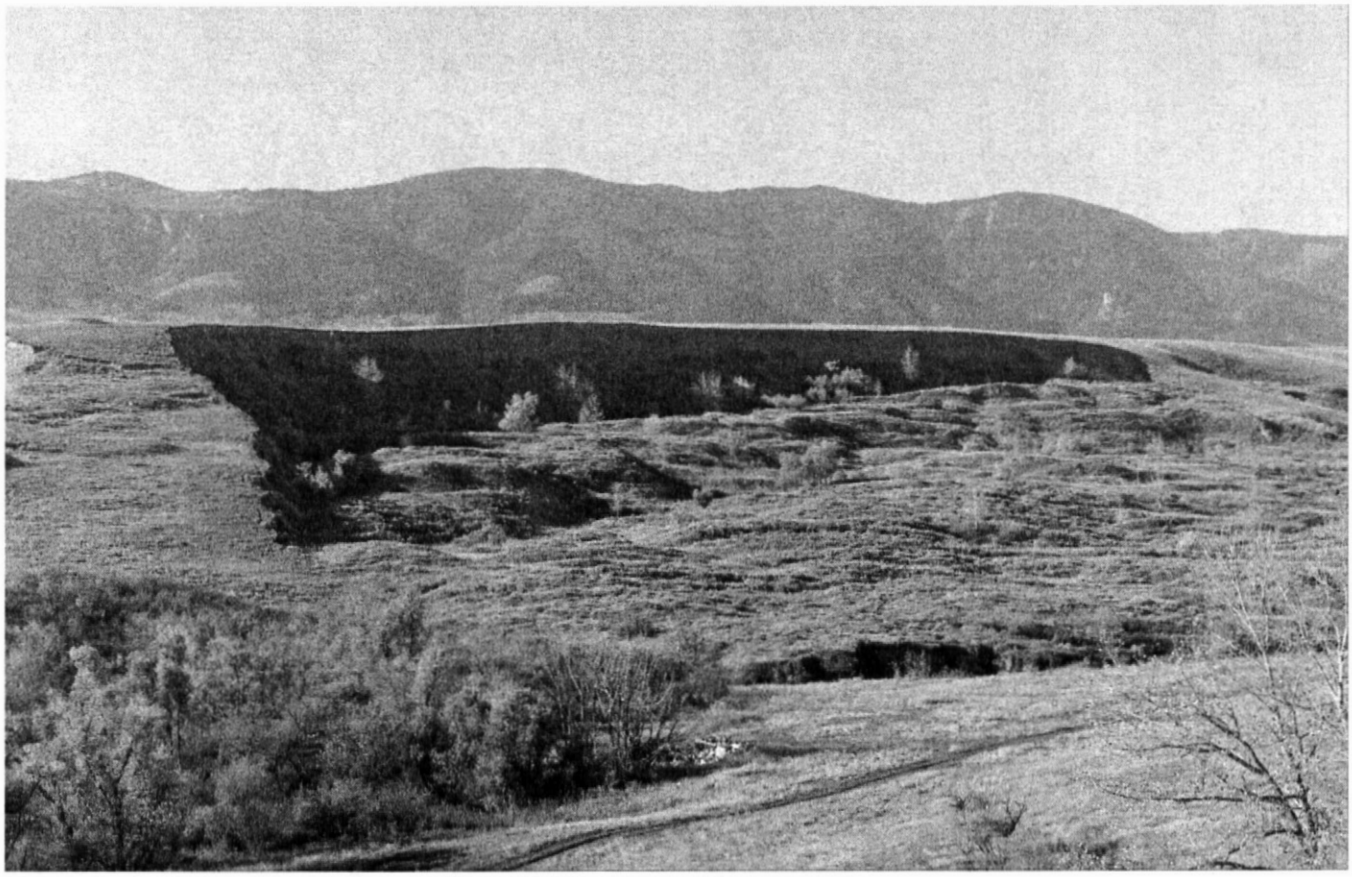


Figure 3.—An area of a landslide on a hillslope. These areas are not suited to roads and homesites.

thunderstorms form in the mountains. These thunderstorms frequently move toward the northeast and give afternoon or evening showers to the Sheridan area.

At other times, winds blowing toward the mountains from the east or northeast are upslope and generally result in cooling, persistent low clouds, and often heavy precipitation. This upslope precipitation occurs throughout the year but most frequently during the winter and spring. The Sheridan area often receives much heavier snow or rain from an easterly wind than the surrounding areas farther away from the mountains.

The semiarid climate of the Sheridan County Area is characterized by long, cold winters and short, hot summers. However, during the winter, the area receives more than 50 percent of the possible sunshine, while summers are marked by very low humidity and cool nights. The average high temperature for January at the Sheridan Agricultural Field Station is about 32 degrees F, and the average low is about 6 degrees F. The average high temperature in July is about 86 degrees F, and the average low is about 51 degrees F. Cold weather comes from outbreaks of frigid Canadian air moving southeast down the eastern slopes of the Rockies. The initial passage of cold air masses is generally accompanied by strong northerly winds, which often causes drifting snow and extreme wind-chill factors. Subzero temperatures at night are associated with these cold spells. These dense air masses generally drift to the east within a week, although three- to four-week periods of cold air are not uncommon. A daily maximum temperature of 90 degrees F is common in July and August, with possible extremes in the low 100's *(U.S. Dep. Commerce, 1984)*. Table 1 contains information on temperature for two stations in the survey area.

On the average, about 60 percent of the normal annual precipitation in the survey area falls during the period of March through July. May and June receive more than 30 percent of the annual total. A secondary peak occurs in September and October. The average snowfall for the Sheridan area is about 70 inches. The greatest amount of snow, almost 13 inches, falls in March. Except for storms in the spring, the water content of the snow generally is low. This dry snow

ordinarily is not harmful to livestock. During March and April, however, precipitation often begins as rain and turns to heavy, wet snow. These spring snowstorms are frequently accompanied by strong winds and subsequent drifting snow. As a result, this time of year generally has the most disagreeable weather and is when the loss of livestock is most likely to occur *(U.S. Dep. Commerce, 1984)*. Table 1 contains information on precipitation for two stations in the survey area.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in the spring and the first freeze in the fall.

The Sheridan County Area has a relatively short growing season, although its length varies widely, both geographically and annually. However, in the areas that have most of the cultivated cropland, the frost- free season averages 100 to 120 days. Freezing temperatures have occurred as late as June 14 and as early as August 24. The average date for the last freeze in the Sheridan area is May 21, and the average date of the first frost is September 18 *(U.S. Dep. Commerce, 1984)*. Table 2 contains information on the probable dates of the freezing temperatures in the spring and fall. Table 3 contains information on the length of the growing season.

Because of the short growing season and cold periods during winter, only the most hardy fruits can be grown successfully, but most varieties of vegetables reach maturity.

How This Survey Was Made

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

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil 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 a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually into 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 usually 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, usually to a depth of 60 inches or to bedrock. 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. In the Sheridan County Area about 113 soil series were identified.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit

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

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

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

General Soil Map Units

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

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas 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 nor 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 descriptions, names, and delineations of the soils in this survey area do not fully agree with those on soil maps of adjacent survey areas in Montana. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

The textural terms used in the descriptive headings refer to the fine-earth portion of the particle-size control section of the soils, as defined in "Soil Taxonomy" *(U.S. Dep. Agric., 1975)*. For most of the soils, the control section includes most or all of the layers below the surface layer and above a depth of 40 inches.

The general soil map of this survey area is part of the State Soil Geographic (STATSGO) Data Base and the general soil map of Wyoming. The map symbols are the same as those for the STATSGO general soil map units. More information about the general soil map units can be obtained from the STATSGO Data Base, available at the local office of the Natural Resources Conservation Service.

The general soil map units in this survey have been grouped for broad interpretive purposes. The map units in each group are described on the following pages.

Soil Descriptions

Areas Dominated by Shallow, Moderately Deep, and Very Deep Soils and Areas of Rock Outcrop; on Mountains

WY060. Tolman-Cloud Peak-Starley

Strongly sloping to very steep, shallow and moderately deep, loamy soils; on mountain slopes, ridges, and hills

This unit is about 35 percent Tolman and similar soils, 20 percent Cloud Peak and similar soils, and 10 percent Starley and similar soils. Slopes are 10 to 75 percent.

The strongly sloping to very steep Tolman soils are on mountain slopes. They are shallow over limestone bedrock and have a surface layer of channery loam and a subsoil of very channery clay loam.

The strongly sloping to very steep Cloud Peak soils are on mountain slopes and ridges. They are moderately deep over limestone bedrock and have a surface layer of gravelly silt loam and a subsoil of very gravelly silty clay loam and extremely cobbly silt loam.

The strongly sloping to very steep Starley soils are on mountain slopes, hills, and ridges. They are shallow over limestone bedrock and have a surface layer of loam and a subsoil of very cobbly loam.

This unit is used for livestock grazing and wildlife habitat. The slope limits access by livestock and the harvesting of timber.

This unit provides winter and year-round habitat for mule deer and summer habitat, critical winter range, and calving areas for elk. In some areas it is frequently inhabited by mountain lions. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, red squirrel, porcupine, coyote, red fox, bobcat, and birds common to shrub steppes and coniferous forests.

This unit joins the Cloud Peak-Starley-Rock outcrop and Owen Creek-Tongue River-Gateway units in the Big Horn National Forest. The Tolman-Cloud Peak-Starley unit is similar to the Cloud Peak-Starley-Rock outcrop unit. The physiography of this unit in the Sheridan County Area is predominantly a continuous

dip slope that has only a small percentage of rock outcrop. The two survey areas join about on the top of this dip slope. The two units have no difference in use and management. The Owen Creek-Tongue River-Gateway unit is of very minor extent in the Sheridan County Area and could not be delineated separately at the scale of the general soil map.

WY061. Agneston-Granile-Rock Outcrop

Areas of Rock outcrop and areas of strongly sloping to steep, moderately deep and very deep, loamy soils; on mountain slopes

This unit is about 35 percent Agneston and similar soils, 20 percent Granile and similar soils, and 15 percent areas of Rock outcrop. Slopes are 10 to 50 percent.

The strongly sloping to steep Agneston soils are on mountain slopes. They are moderately deep over granite bedrock and have a surface layer of gravelly coarse sandy loam and a subsoil of very gravelly sandy clay loam.

The strongly sloping and moderately steep Granile soils are on mountain slopes. They are very deep and have a surface layer of gravelly sandy loam, a subsoil of very gravelly sandy clay loam, and a substratum of very gravelly sandy loam.

The areas of Rock outcrop consist of granite, schist, limestone, sandstone, and shale.

This unit is used for livestock grazing and wildlife habitat. Livestock grazing is limited by the slope and the low productivity of the understory vegetation. Roads and trails are subject to a severe hazard of water erosion if the grades are too steep. Constructing water bars helps to reduce the velocity of runoff on roads and trails that cross the steep slopes.

This unit provides summer habitat for elk and moose. Areas of the unit are used by mule deer during the summer and more intensively during the winter. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

Areas Dominated by Shallow and Very Deep Soils; on Hills, Terraces, and Alluvial Fans Adjacent to Mountains

WY371. Norbert-Savage-Savar

Nearly level to steep, shallow and very deep, clayey soils; on hills, terraces, and alluvial fans

This unit is about 25 percent Norbert and similar soils, 25 percent Savage and similar soils, and 15 percent Savar and similar soils. Slopes are 0 to 45 percent.

The strongly sloping to steep Norbert soils are on hills. They are shallow over soft shale bedrock and have a surface layer and underlying material of clay.

The nearly level to strongly sloping Savage soils are on alluvial fans, terraces, and hillslopes. They are very deep and have a surface layer of silt loam and a subsoil of silty clay loam.

The gently sloping to strongly sloping Savar soils are on alluvial fans and hillslopes. They are very deep and have a surface layer of clay loam and a subsoil of clay.

This unit is used for livestock grazing, irrigated and nonirrigated cropland, and wildlife habitat. The nearly level to moderately sloping Savage and Savar soils are well suited to cropland. Runoff is rapid on the steeper slopes, and a severe hazard of water erosion occurs unless a good plant cover is maintained. The steeper soils are very unstable and are commonly subject to soil creep and slippage, especially on south- and east-facing slopes.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. A high concentration of strutting areas for sharptail grouse is west of Parkman. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Wayden-Xavier-Belfield association in Montana. The Norbert-Savage-Savar map unit does not match at the Wyoming-Montana border because no Xavier or Belfield soils are mapped at this location. These soils occur farther north of the State line. The Wayden soils are of minor extent in the Norbert-Savage-Savar map unit.

WY372. Trimad-Trivar-Abac

Nearly level to steep, shallow and very deep, loamy soils; on mountain toe slopes, dip slopes, terraces, terrace escarpments, and alluvial fans

This unit is about 30 percent Trimad and similar soils, 20 percent Trivar and similar soils, and 15 percent Abac and similar soils. Slopes are 0 to 50 percent.

The nearly level to steep Trimad soils are on terrace escarpments, alluvial fans, and terraces. They are very deep and have a surface layer of gravelly loam, a subsoil of very gravelly loam, and a substratum of extremely gravelly loam.

The nearly level to moderately steep Trivar soils are on mountain toe slopes and terraces. They are very

deep and are silt loam in the surface layer and in the upper part of the subsoil and gravelly sandy loam in the lower part of the subsoil.

The steep Abac soils are on dip slopes. They are shallow over shale bedrock and have a surface layer of silt loam and underlying material of gravelly loam.

This unit is used for livestock grazing and wildlife habitat. Access by livestock is limited in many areas because of the slope.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Abac-Peritsa map unit in Montana. Larger areas of the Chugwater geological formation occur in Montana than in the Sheridan County Area; consequently, larger areas and acreages of the Abac and Peritsa soils, which occur in areas of this formation, are in Montana. Peritsa soils are of minor extent in the Trimad-Trivar-Abac map unit in the Sheridan County Area. The two map units have no difference in use and management.

Areas Dominated by Shallow, Moderately Deep, and Very Deep Soils and Areas of Rock Outcrop; on Hills, Terraces, and Alluvial Fans

WY049. Shingle-Theedle-Bidman

Nearly level to very steep, shallow, moderately deep, and very deep, loamy and clayey soils; on ridges, hills, and alluvial fans

This unit is about 30 percent Shingle and similar soils, 30 percent Theedle and similar soils, and 10 percent Bidman and similar soils. Slopes range from 0 to 75 percent.

The moderately sloping to very steep Shingle soils are on ridges and hills. They are shallow over soft shale bedrock and have a surface layer and underlying material of clay loam.

The moderately sloping to very steep Theedle soils are on the lower part of hillslopes and ridges. They are moderately deep over soft shale bedrock and have a surface layer of loam and underlying material of loam or clay loam.

The nearly level to strongly sloping Bidman soils are on alluvial fans, terraces, and toe slopes. They are very deep. They have a surface layer of loam and have clay in the upper part of the subsoil and clay loam in the lower part of the subsoil.

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for nonirrigated hay or cultivated crops. The nearly level to moderately sloping Bidman soils are well suited to hay and cultivated crops. Access by livestock is limited by the slope and the deep, steep-sided gullies. Overgrazing is a management concern because of the inaccessibility of the steeper slopes. Overgrazed areas become heavily infested with pricklypear and cheatgrass.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter and also by pronghorn antelope during the winter in the areas northwest and north of Clearmont. The unit provides nesting areas for golden eagles. The areas of this unit southeast of Arvada are used by elk throughout the year. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY056. Worfka-Samday-Parmleed

Nearly level to very steep, shallow and moderately deep, clayey soils; on hills, ridges, and tablelands

This map unit is about 40 percent Worfka and similar soils, 15 percent Samday and similar soils, and 15 percent Parmleed and similar soils. Slopes are 0 to 60 percent.

The moderately sloping to moderately steep Worfka soils are on hills. They are shallow over soft shale bedrock and have a surface layer of fine sandy loam and a subsoil of clay.

The moderately sloping to very steep Samday soils are on ridges and hills. They are shallow over soft shale bedrock and have a surface layer of clay loam and underlying material of clay.

The nearly level to strongly sloping Parmleed soils are on tablelands and hillslopes. They are moderately deep over soft shale bedrock. They have a surface layer of very fine sandy loam or loam and a subsoil of clay in the upper part and clay loam in the lower part.

This unit is used for livestock grazing and wildlife habitat. A few areas are used as irrigated hayland. Overgrazing results in severe hazards of wind and water erosion and reduces the amount of desirable grass species. The Parmleed and similar soils are well suited to irrigation.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer in the winter. The unit provides strutting areas for sharp-tailed grouse and sage grouse and nesting areas for golden eagles. It also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY109. Shingle-Kishona-Cambria

Nearly level to very steep, shallow and very deep, loamy soils; on hills, ridges, alluvial fans, and terraces

This unit is about 30 percent Shingle and similar soils, 20 percent Kishona and similar soils, and 15 percent Cambria and similar soils. Slopes are 0 to 65 percent.

The moderately sloping to very steep Shingle soils are on ridges. They are shallow over soft shale bedrock and have a surface layer and underlying material of clay loam.

The nearly level to strongly sloping Kishona soils are on hillslopes and alluvial fans. They are very deep and have a surface layer of loam and a subsoil of loam or clay loam.

The nearly level to strongly sloping Cambria soils are on alluvial fans and terraces. They are very deep. They have a surface layer of loam and a subsoil of clay loam in the upper part and loam in the lower part.

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for nonirrigated hay. The Kishona and Cambria soils are well suited to nonirrigated hay. The unit has good potential for rangeland forage; however, overgrazed areas become heavily infested with pricklypear and cheatgrass.

This unit provides year-round habitat for mule deer, white-tailed deer, and pronghorn antelope. It is more intensively used by mule deer during the winter. Several strutting areas for sharptail grouse are near Dutch Creek. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Thedalund-Midway unit in Montana. Since the Montana soil survey was completed in 1970, the Theedle soil, a minor soil in this unit, was established to recognize differences in soil moisture. The Theedle and Thedalund soils are similar. They have no difference in use and management. The Shingle soils contain slightly less clay than the Midway soils but are otherwise similar to the Shingle soils and have no difference in use and management.

WY113. Shingle-Samday-Rock Outcrop

Areas of Rock outcrop and areas of gently sloping to very steep, shallow, loamy and clayey soils; on hills and ridges

This map unit is about 40 percent Shingle and similar soils, 20 percent Samday and similar soils, and 15 percent areas of Rock outcrop. Slopes are 3 to 65 percent.

The gently sloping to very steep Shingle soils are on ridges and hills. They are shallow over soft shale bedrock and have a surface layer and underlying material of clay loam.

The gently sloping to very steep Samday soils are on ridges and hills. They are shallow over soft shale bedrock and have a surface layer of clay loam and underlying material of clay.

The areas of Rock outcrop are commonly shale but are sandstone in some areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations are the slope and the broken, dissected topography, both of which limit the movement of and access by livestock. Overgrazing is a management concern because of the inaccessibility of the steeper slopes. Overgrazed areas become heavily infested with pricklypear and cheatgrass.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. The unit provides nesting areas for golden eagles. It also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Kyle-Midway-Cabba association in Montana. Since the Montana soils report was published in 1971, new soils have been established that recognize differences in soil moisture that were previously included within a single soil concept. The Bahl soils are of minor extent in the Sheridan County Area. They are similar to the Kyle soils, but the Kyle soils are deep and the Bahl soils are very deep. The two soils have no difference in use and management. The Samday soils are similar to the Midway soils and have no difference in use and management. The Shingle soils are similar to the Cabba soils and have no difference in use and management.

WY370. Baux-Shingle-Kirtley

Nearly level to very steep, shallow, moderately deep, and very deep, loamy soils; on ridges and hills

This map unit is about 25 percent Baux and similar soils, 25 percent Shingle and similar soils, and 15 percent Kirtley and similar soils. Slopes are 0 to 65 percent.

The nearly level to very steep Baux soils are on ridges. They are very deep but have a shallow rooting depth. They have a surface layer of channery loam and very channery loam and are underlain by fractured porcellanite material that has little or no earthy material between the rock fragments.

The nearly level to very steep Shingle soils are on ridges. They are shallow over soft shale bedrock and

have a surface layer and underlying material of clay loam.

The gently sloping to strongly sloping Kirtley soils are on hillslopes. They are moderately deep over soft shale bedrock and have a surface layer of loam and a subsoil of clay loam.

This unit is used for livestock grazing and wildlife habitat. The main limitations on this unit are the slope and the rooting depth. Overgrazing results in a decrease of desirable forage and an increase in undesirable plants.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. The unit provides nesting areas for golden eagles. It also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY373. Rock Outcrop-Norbert-Reget

Areas of Rock outcrop and areas of gently sloping to steep, shallow and moderately deep, clayey soils; on hills and dip slopes

This map unit is about 30 percent areas of Rock outcrop, 20 percent Norbert and similar soils, and 15 percent Reget and similar soils. Slopes are 3 to 45 percent.

The Rock outcrop is in very steep and vertical areas on hills. It consists of shale that is capped with beds of porcellanite.

The strongly sloping to very steep Norbert soils are on hills. They are shallow over soft shale bedrock and have a surface layer of clay and underlying material of silty clay.

The gently sloping to steep Reget soils are on hills and dip slopes. They are moderately deep over soft shale bedrock and have a surface layer of clay loam and a subsoil of clay.

This unit is mainly used for livestock grazing and wildlife habitat. A few small areas of minor soils in the valleys are used as irrigated hayland. Overgrazing on the steeper slopes results in severe hazards of wind and water erosion. The steeper Norbert soils are very unstable and are subject to soil creep and sliding, especially on south- and east-facing slopes.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. Nesting areas for golden eagles and strutting areas for sage grouse and sharp-tailed grouse are in this unit. It also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Wayden-Regent-Shale outcrop association in Montana. The Norbert soils are similar to the Wayden soils in Montana and have no difference in use and management. The Reget soils have a subsoil of clay, and the Regent soils have a subsoil of silty clay or silty clay loam. These soils have no difference in use and management. Because of different patterns of geologic erosion near the boundary between Wyoming and Montana, the percentage of Wayden soils in this area in Montana is larger than that in Wyoming.

Areas Dominated by Shallow, Moderately Deep, and Very Deep Soils on Terraces, Alluvial Fans, and Hills

WY051. Bidman-Ulm-Wyarno

Nearly level to strongly sloping, very deep, clayey soils; on hillslopes, alluvial fans, and terraces

This map unit is about 25 percent Bidman and similar soils, 20 percent Ulm and similar soils, and 20 percent Wyarno and similar soils. Slopes range from 0 to 15 percent.

The nearly level to strongly sloping Bidman soils are on hillslopes, alluvial fans, and terraces. They are very deep and have a surface layer of loam and a subsoil of clay loam.

The nearly level to strongly sloping Ulm soils are on alluvial fans, terraces, and toe slopes. They are very deep and have a surface layer of loam and a subsoil of clay loam.

The nearly level to moderately sloping Wyarno soils are on alluvial fans, terraces, and hillslopes. They are very deep. They have a surface layer of clay loam. The subsoil is silty clay loam in the upper part and clay loam in the lower part.

This unit is used for livestock grazing, wildlife habitat, and nonirrigated hay and cultivated crops. The nearly level to moderately sloping areas are well suited to hay and crops. Low amounts of precipitation limit yields. When overgrazed, these soils become heavily infested with pricklypear and cheatgrass.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY057. Doney-Farnuf-Reeder

Nearly level to very steep, moderately deep and very deep, loamy soils; on hills, terraces, and alluvial fans

This unit is about 35 percent Doney and similar soils, 20 percent Farnuf and similar soils, and 10 percent Reeder and similar soils. Slopes are 0 to 75 percent.

The moderately steep to very steep Doney soils are on ridges and the upper part of hillslopes. They are moderately deep over soft shale bedrock and have a surface layer of silt loam and a subsoil of silty clay loam.

The nearly level to strongly sloping Farnuf soils are on alluvial fans, terraces, and hillslopes. They are very deep. They have a surface layer of silt loam. They have a subsoil of clay loam in the upper part and loam in the lower part.

The gently sloping to strongly sloping Reeder soils are on hillslopes. They are moderately deep over soft shale bedrock. They have a surface layer of loam. They have a subsoil of clay loam in the upper part and loam in the lower part.

This unit is used for livestock grazing, irrigated and nonirrigated hay, and nonirrigated cultivated crops. The nearly level to moderately sloping Farnuf and Reeder soils are well suited to hay and cultivated crops. Properly managing irrigation water helps to prevent the formation of a water table in these soils. Water erosion is a hazard in the more sloping areas.

This unit provides year-round habitat for mule deer, white-tailed deer, and pronghorn antelope. It is more intensively used by mule deer during the winter. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

This unit joins the Doney-Reeder-Wayden association in Montana. The use and management of both units are similar. The Doney soils in Wyoming have more silt than those in Montana, but their use and management are the same. Because of the nature of the terrain, a lower percentage of Wayden soils and a higher percentage of Farnuf soils occur in the Sheridan County Area than in Montana. The Wayden soils are of minor extent in the Doney-Reeder-Farnuf map unit in the Sheridan County Area.

WY063. Nuncho-Platsher-Samday

Nearly level to very steep, shallow and very deep, clayey soils; on terraces, hills, and alluvial fans

This map unit is about 25 percent Nuncho and similar soils, 25 percent Platsher and similar soils, and 15 percent Samday and similar soils. Slopes are 0 to 60 percent.

The gently sloping to strongly sloping Nuncho soils are on alluvial fans, toe slopes, and terraces. They are very deep. They have a surface layer of loam. They have a subsoil of clay in the upper part and clay loam in the lower part.

The nearly level to moderately sloping Platsher soils are on terraces. They are very deep. They have a surface layer of loam. They have a subsoil of clay in the upper part and gravelly clay loam in the lower part.

The gently sloping to very steep Samday soils are on hills and ridges. They are shallow over soft shale bedrock and have a surface layer of clay loam and underlying material of clay.

This unit is used for livestock grazing, wildlife habitat, irrigated hay, and nonirrigated cultivated crops. Overgrazing increases the severe hazard of erosion on the steeper soils. The nearly level to moderately sloping Nuncho and Platsher soils are well suited to hay and crops. Irrigation water needs to be applied properly to prevent the buildup of a water table in these soils. The Samday soils are very unstable and are subject to soil creep and sliding, especially on south- and east-facing slopes.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. Northwest of Story, it is used by moose for year-round habitat and critical winter range. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY064. Bidman-Parmleed-Shingle

Nearly level to very steep, shallow, moderately deep, and very deep, clayey and loamy soils; on terraces, tablelands, ridges, hills, and alluvial fans

This map unit is about 30 percent Bidman and similar soils, 25 percent Parmleed and similar soils, and 15 percent Shingle and similar soils. Slopes are 0 to 65 percent.

The nearly level to strongly sloping Bidman soils are on terraces, the lower part of hillslopes, and alluvial fans. They are very deep. They have a surface layer of loam. They have a subsoil of clay loam or clay in the upper part and clay loam in the lower part.

The nearly level to moderately steep Parmleed soils are on tablelands and hills. They are moderately deep over shale bedrock. They have a surface layer of loam. They have a subsoil of clay in the upper part and clay loam in the lower part.

The strongly sloping to very steep Shingle soils are on hills and ridges. They are shallow over soft shale bedrock and have a surface layer and underlying material of clay loam.

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for nonirrigated hay or cultivated crops. Only the nearly level to moderately sloping Parmleed and Bidman soils are suitable for cultivated crops. The unit has good potential for rangeland forage, but overgrazing reduces the amount of desirable grass species and increases the amount of undesirable grasses and shrubs.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. Its use by pronghorn antelope during the winter is more intensive about 10 miles north-northeast of Sheridan. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY065. Nuncho-Recluse-Baux

Nearly level to very steep, very deep, loamy and clayey soils; on hills, alluvial fans, and ridges

This map unit is about 25 percent Nuncho soils, 25 percent Recluse soils, and 15 percent Baux soils. Slopes are 0 to 65 percent.

The nearly level to strongly sloping Nuncho soils are on terraces and alluvial fans adjacent to drainageways. They have a surface layer of loam. They have a subsoil of clay in the upper part and clay loam in the lower part.

The nearly level to strongly sloping Recluse soils are on hillslopes and alluvial fans adjacent to drainageways. They are very deep. They have a surface layer of loam. They have a subsoil of clay loam in the upper part and loam in the lower part.

The nearly level to very steep Baux soils are on ridges. They are very deep but have a shallow rooting depth. They have a surface layer of channery loam and very channery loam and are underlain by fractured porcellanite material that contains little or no earthy material between the rock fragments.

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for nonirrigated hay. The unit is well suited to livestock grazing. The slope limits access by livestock in a few areas. The nearly level to moderately sloping Nuncho and Recluse soils are well suited to nonirrigated hay. They produce good yields of forage. Overgrazing results in a reduction of desirable grass species and an increase in undesirable grasses and shrubs.

This unit provides year-round habitat for mule deer and pronghorn antelope. It is more intensively used by mule deer during the winter. The southern half of the unit provides nesting areas for golden eagles. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

WY066. Moskee-Hargreave

Nearly level to strongly sloping, moderately deep and very deep, loamy soils; on hillslopes and alluvial fans

This map unit is about 45 percent Moskee and similar soils and 25 percent Hargreave and similar soils. Slopes are 0 to 15 percent.

The nearly level to strongly sloping Moskee soils are on alluvial fans and hillslopes. They are very deep. They have a surface layer of fine sandy loam. They have a subsoil of sandy clay loam in the upper part and sandy loam or sandy clay loam in the lower part.

The gently sloping to strongly sloping Hargreave soils are on hillslopes. They are moderately deep over sandstone bedrock and have a surface layer of fine sandy loam and a subsoil of sandy clay loam.

This unit is used for irrigated hay, livestock grazing, and wildlife habitat. The nearly level to moderately sloping soils are well suited to irrigation.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. The areas of this unit northwest of Story provide critical winter range for elk and moose. Areas of the unit are used by elk for calving. Strutting areas for sharptail grouse are in the upper reaches of Little Goose Creek. The unit also is inhabited by white-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, grasslands, and prairies.

Areas Dominated by Very Deep Soils on Flood Plains, Low Terraces, and Alluvial Fans

WY048. Haverdad-Kishona-Draknab

Nearly level and gently sloping, very deep, loamy and sandy soils; on alluvial fans, terraces, and flood plains

This map unit is about 30 percent Haverdad and similar soils, 30 percent Kishona and similar soils, and 10 percent Draknab and similar soils. Slopes are 0 to 6 percent.

The nearly level Haverdad soils are on low terraces and flood plains. They are very deep and have a surface layer of very fine sandy loam and underlying

material of stratified loam, clay loam, sandy loam, and silt loam.

The nearly level and gently sloping Kishona soils are on high terraces and alluvial fans. They are very deep and have a surface layer of loam and a subsoil of loam or clay loam.

The nearly level Draknab soils are on flood plains. They are very deep and have a surface layer of loamy fine sand and underlying material of stratified loamy sand, sandy loam, and sand.

This unit is used for irrigated and nonirrigated cultivated crops and hay, for livestock grazing, and as wildlife habitat. Few limitations affect these uses. Some of the lower lying areas are subject to seasonal flooding. Overgrazed areas become heavily infested with pricklypear and cheatgrass. Irrigation water needs to be applied properly to prevent the buildup of a water table, especially where a flood irrigation system is used.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. The unit also is inhabited by Merriam's turkey, muskrat, beaver, raccoon, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, and birds common to shrub steppes, fields, areas of wetland shrubs and trees, and riverine areas.

WY055. Haverdad-Zigweid-Nuncho

Nearly level and gently sloping, very deep, loamy and clayey soils; on alluvial fans, terraces, and flood plains

This map unit is about 30 percent Haverdad and similar soils, 20 percent Zigweid and similar soils, and 15 percent Nuncho and similar soils. Slopes are 0 to 6 percent.

The nearly level Haverdad soils are on flood plains. They are very deep and have a surface layer of very fine sandy loam and underlying material of stratified loam, sandy loam, clay loam, and silt loam.

The nearly level and gently sloping Zigweid soils are on terraces and alluvial fans. They are very deep and have a surface layer of loam and a subsoil of loam or clay loam.

The nearly level and gently sloping Nuncho soils are on terraces and alluvial fans. They are very deep. They have a surface layer of loam. They have a subsoil of clay in the upper part and clay loam in the lower part.

This unit is used for irrigated and nonirrigated hay and cultivated crops, urban development, wildlife habitat, and livestock grazing. In most areas few limitations affect hayland, cropland, livestock grazing, and wildlife habitat. The Nuncho soils are limited as sites for septic tank absorption fields by the slow permeability and as sites for dwellings by a high shrink-swell potential. Seasonal flooding is a hazard on the Haverdad soils.

This unit provides year-round habitat for mule deer and white-tailed deer. It is more intensively used by mule deer during the winter. The unit also is inhabited by muskrat, beaver, raccoon, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, and birds common to shrub steppes, fields, areas of wetland shrubs and trees, and riverine areas.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils 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 have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils 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 is needed to define and locate the soils and miscellaneous areas.

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer 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, Nuncho clay loam is a phase of the Nuncho 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.

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 these soils or miscellaneous areas separately. The pattern and relative proportion of the soils are somewhat similar.

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

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

Soil Descriptions

100—Abac-Rock outcrop complex, 35 to 50 percent slopes. This map unit is on dip slopes. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is about 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 60 percent Abac silt loam, 35 to 50 percent slopes, on hillcrests and dip slopes between the areas of Rock outcrop and 30 percent areas of 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 areas of Twin Creek loam and Sinkson silt loam. Inclusions make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Abac soil is shallow and well drained. It formed in residuum derived from interbedded red shale and sandstone. Typically, the surface layer is reddish brown silt loam about 3 inches thick. The underlying material is yellowish red gravelly loam about 15 inches thick over soft shale and sandstone. Depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Abac soil. Available water capacity is very low. The 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 areas of Rock outcrop consist of several rock ledges 5 to 30 feet thick in a stairstep pattern on the sides of dip slopes and hills.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, little bluestem, and green needlegrass. The potential plant community produces about 1,800 pounds of air-dry vegetation per acre in normal years. Production varies from 1,400 pounds in favorable years to 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope, the depth to bedrock, and the areas of Rock outcrop.

The Abac soil is in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Abac soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

101—Absted-Haverdad association, 0 to 6 percent slopes. This map unit is on flood plains, alluvial fans, drainageways, and low terraces adjacent to streams and intermittent drainageways. Areas are elongated and irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is about 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Absted very fine sandy loam on alluvial fans and terraces and 35 percent Haverdad very fine sandy loam on low terraces, flood plains, and the bottoms of drainageways.

Included in this unit are small areas of Slickspots, Ulm clay loam, Wyarno clay loam, and Kishona 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 alkaline shale. Typically, the surface layer is light gray very fine sandy loam about 3 inches thick. The upper 7 inches of the subsoil is grayish brown clay. The next 7 inches is strongly alkaline, grayish brown clay. The lower part to a depth of 60 inches or more is very strongly alkaline, grayish brown clay loam.

Permeability is slow in the Absted soil. Available water capacity is moderate. The 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 Haverdad soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light gray loam stratified with lenses of sandy loam, silt loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 rare flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Absted soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The potential plant community on the Haverdad soil is mainly basin wildrye, western wheatgrass, and green needlegrass. 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. As the ecological condition deteriorates, blue grama and woody plants increase. As the ecological condition further deteriorates, annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

The Absted soil is in capability subclass VIs, nonirrigated, and the Haverdad soil is in capability subclass IVe, nonirrigated. The Absted soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Haverdad soil is in the Overflow, 10- to 14-inch precipitation zone, Northern Plains range site.

102—Absted-Haverdad association, moist, 0 to 6 percent slopes. This map unit is on flood plains, alluvial fans, drainageways, and low terraces. Areas are elongated and irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is about 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Absted clay loam on terraces and alluvial fans and 35 percent Haverdad very fine sandy loam on low terraces, flood plains, and the bottoms of drainageways.

Included in this unit are small areas of Slickspots, Ulm clay loam, Wyarno clay loam, and Kishona 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 alkaline shale. Typically, the surface layer is grayish brown clay loam about 3 inches thick. The upper 10 inches of the subsoil is pale brown clay loam about 10 inches thick. The next 13 inches is strongly alkaline, grayish brown clay. The lower part to a depth of 60 inches or more is very strongly alkaline, pale brown clay loam. In some areas the surface layer is fine sandy loam or loam. In areas near drainageways the lower part of the subsoil

is stratified. In other areas the soil has 10 to 15 percent lignite fragments throughout the profile.

Permeability is slow in the Absted soil. Available water capacity is high. The 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 Haverdad soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light gray to dark yellowish brown loam stratified with lenses of sandy loam, silt loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 rare flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Absted soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Haverdad soil is mainly green needlegrass, basin wildrye, and Columbia needlegrass. The potential plant community produces about 3,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass and annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Absted soil for rangeland seeding is good. The suitability of the Haverdad soil for rangeland seeding is fair. The main management concern is the hazard of wind erosion on the Haverdad soil. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

The Absted soil is in capability subclass VIs, nonirrigated, and the Haverdad soil is in capability subclass IVe, nonirrigated. The Absted soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Haverdad soil is in the Overflow, 15- to 19-inch precipitation zone, Northern Plains range site.

103—Absted-Slickspots complex, 0 to 6 percent slopes. This map unit is on alluvial fans and terraces. Areas are deltaic in shape and elongated and are 15 to 80 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Absted fine sandy loam and 35 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 clay loam, Wyarno clay loam, and Arvada fine sandy loam. Also included in this unit on low terraces in the Buffalo Creek drainageway are areas of soils that have a very strongly alkaline, sandy clay loam subsoil. Also included on terraces adjacent to Clear Creek, the Powder River, and the Tongue River are areas of soils that have gravel and sand at a depth of 30 to 70 inches. In the Parkman area the average annual temperature is 2 to 3 degrees cooler and the frost-free period is 80 to 100 days. 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 alkaline shale. Typically, the surface layer is light gray fine sandy loam about 2 inches thick. The upper 6 inches of the subsoil is brown clay. The next 5 inches is strongly alkaline brown clay. The lower part to a depth of 60 inches or more is very strongly alkaline pale brown clay loam.

Permeability is slow in the Absted soil. Available water capacity is moderate. The 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.

Slickspots are areas 2 to 10 feet in diameter that are generally barren of vegetation. They generally have a thin, very strongly alkaline, white loamy surface layer 1 to 2 inches thick. The subsoil and substratum are commonly clayey and very strongly alkaline.

Permeability is very slow in the Slickspots. Available water capacity is very low. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Absted soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed 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. The Absted soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Slickspots is limited by salinity and alkalinity. The suitability of the Absted soil for rangeland seeding is fair. The main management concern is the hazard of wind erosion. The suitability of the Slickspots for rangeland seeding is very poor. The main limitations are the very high salinity and alkalinity. Attempts to establish plants on the Slickspots generally are unsuccessful. If the existing plant cover is removed during seeding on the Absted soil, a cover crop is needed to minimize the hazard of wind erosion.

The Absted soil is in capability subclass VIs, nonirrigated, and the Slickspots are in capability class VIII. The Absted soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

104—Agneston-Granile-Rock outcrop association, 10 to 50 percent slopes. This map unit is on mountain slopes. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly coniferous trees and grasses. The canopy cover is 75 to 100 percent. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 20 to 30 inches, the average annual temperature is 39 to 41 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 30 percent Agneston gravelly coarse sandy loam, 10 to 50 percent slopes, on mountain back slopes and foot slopes; 25 percent Granile gravelly sandy loam, 10 to 20 percent slopes, on mountain foot slopes; and 25 percent areas of Rock outcrop.

Included in this unit are small areas of Cloud Peak gravelly loam and soils that are similar to the Agneston soil but are reddish. Included areas make up about 20 percent of the total area. The percentage varies from one area to another.

The Agneston soil is moderately deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface is covered with a layer of undecomposed and partly decomposed needles and other plant litter 3 inches thick. The surface layer is brown gravelly coarse sandy loam about 6 inches thick. The subsoil is yellowish brown very gravelly sandy clay loam about 23 inches thick over hard, granitic bedrock. Depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Agneston soil. Available water capacity is very low. The 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 Granile soil is very deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface is covered with a layer of partly decomposed plant litter 2 inches thick. The surface layer is brown gravelly sandy loam about 8 inches thick. The subsoil is pale brown very gravelly sandy clay loam about 11 inches thick. The substratum to a depth of 60 inches or more is yellowish brown very gravelly sandy loam.

Permeability is moderate in the Granile soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The areas of Rock outcrop consist of exposures of granite and gneiss.

This unit is used for wildlife habitat.

The plant community consists of an overstory of mainly Douglas-fir, Engelmann spruce, ponderosa pine, and limber pine with an understory of Saskatoon serviceberry, Oregongrape, common juniper, heartleaf arnica, and bedstraw. The production of vegetation suitable for livestock grazing is limited by the canopy cover.

The Agneston soil is in capability subclass VIIe, nonirrigated; the Granile soil is in capability subclass VIs, nonirrigated; and the areas of Rock outcrop are in capability class VIII. This unit is a woodland site.

105—Arnegard-Farnuf association, 0 to 6 percent slopes. This map unit is on alluvial fans and terraces. Areas are deltaic and irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Arnegard loam, 0 to 6 percent slopes, and 35 percent Farnuf loam, 2 to 6 percent slopes.

Included in this unit are areas of Savage silt loam, Savar clay loam, and Reget silty clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Arnegard soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is dark grayish brown loam about 4 inches thick. The upper 26 inches of the subsoil is dark grayish brown clay loam. The next 11 inches is grayish brown clay loam. The lower part to a depth of 60 inches or more is light brownish gray clay loam.

Permeability is moderate in the Arnegard soil. Available water capacity is high. The 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 Farnuf soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark grayish brown loam about 5 inches thick. The upper part of the subsoil is brown clay loam about 17 inches thick. The lower part to a depth of 60 inches or more is yellowish brown clay loam.

Permeability is moderate in the Farnuf soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat. It also is used for irrigated and nonirrigated crops.

If this unit is used for crops, the main limitation is the short growing season. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly green needlegrass, spike fescue, Idaho fescue, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

106—Arnegard-Farnuf association, 6 to 25 percent slopes. This map unit is on alluvial fans and hillslopes. Areas are deltaic and irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, but additional moisture is received from accumulations of drifted snow. The average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 55 percent Arnegard loam, 6 to 20 percent slopes, on alluvial fans and the lower part of hillslopes and 25 percent Farnuf loam, 9 to 25 percent slopes, on the upper part of hillslopes.

Included in this unit are areas of Savar clay loam, Savage silt loam, Reget silty clay loam, Reeder loam, and shallow, clayey soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Arnegard soil is very deep and well drained. It formed in colluvium and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The upper 14 inches of the subsoil is dark brown

and dark grayish brown loam. The next part is grayish brown loam about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray loam.

Permeability is moderate in the Arnegard soil. Available water capacity is high. The 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 Farnuf soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown loam about 7 inches thick. The upper 16 inches of the subsoil is brown clay loam. The next 5 inches is grayish brown clay loam. The lower part to a depth of 60 inches or more is pale brown loam.

Permeability is moderate in the Farnuf soil. Available water capacity is high. The 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 mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly green needlegrass, spike fescue, Idaho fescue, western wheatgrass, and needleandthread. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

In the Pass Creek area the plant community includes a dense brush overstory of wild plum, hawthorn, common chokecherry, and a few aspen, with an understory of green needlegrass, spike fescue, Idaho fescue, western wheatgrass, and needleandthread.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass VIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

107—Assinniboine-Dast association, 3 to 65 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is about 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Assinniboine fine sandy loam, 3 to 45 percent slopes, on hillslopes and 35 percent Dast fine sandy loam, 3 to 65 percent slopes, on hillcrests.

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

The Assinniboine soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam about 4 inches thick. The upper 10 inches of the subsoil is dark grayish brown sandy clay loam. The next 9 inches is light brownish gray sandy clay loam. The lower part to a depth of 60 inches or more is light yellowish brown and pale brown sandy loam.

Permeability is moderate in the Assinniboine soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Dast soil is moderately deep and well drained. It formed in residuum and alluvium derived from sandstone. Typically, the surface layer is dark brown fine sandy loam about 4 inches thick. The upper 21 inches of the subsoil is light yellowish brown fine sandy loam. The lower 15 inches is light olive brown fine sandy loam over soft sandstone. Depth to bedrock is 20 to 40 inches.

Permeability is moderately rapid in the Dast soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is prairie sandreed, sand bluestem, needleandthread, and western wheatgrass. The potential plant community

produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. The slope, however, limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIe, nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

108—Baux-Bauxson association, 0 to 65 percent slopes. This map unit is on ridges and hillslopes. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Baux channery loam on ridges and 30 percent Bauxson channery loam on hillslopes.

Included in this unit are small areas of Reddale channery loam and Wibaux channery loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish gray channery loam about 9 inches thick. The upper 4 inches of the underlying material is reddish gray very channery loam. The lower part to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 20 inches.

Permeability in the Baux soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The 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 Bauxson soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish brown channery loam about 5 inches thick. The subsoil is reddish brown clay loam about 14 inches thick. The substratum to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Bauxson soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, spike fescue, and western wheatgrass. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, blue grama, and shrubs increase. As the ecological condition further deteriorates, thistle and gumweed invade.

The potential plant community on the Bauxson soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing on the Baux soil is limited by droughtiness. The Bauxson soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Baux soil is in the Very Shallow,

15- to 19-inch precipitation zone, Northern Plains range site. The Bauxson soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

109—Baux-Bauxson association, dry, 0 to 65 percent slopes. This map unit is on ridges and hillslopes. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Baux channery loam on ridges and 30 percent Bauxson channery loam on hillslopes.

Included in this unit are small areas of Wibaux channery loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish gray channery loam about 1 inch thick. The lower 12 inches is reddish gray very channery loam. The underlying material to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 20 inches.

Permeability in the Baux soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is very low. The 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 Bauxson soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish gray channery loam about 2 inches thick. The upper part of the subsoil is reddish gray clay loam about 9 inches thick. The lower 5 inches is reddish brown very channery clay loam. The substratum to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Bauxson soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is very low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, and western wheatgrass. 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. As the ecological condition deteriorates, woody plants increase. As the ecological condition further deteriorates, annuals invade.

The potential plant community on the Bauxson soil is mainly bluebunch wheatgrass, needleandthread, blue grama, and western wheatgrass. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing on the Baux soil is limited by droughtiness. The Bauxson soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Baux soil is in the Very Shallow, 10- to 14-inch precipitation zone, Northern Plains range site. The Bauxson soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

110—Baux-Bauxson-Kirtley association, 3 to 60 percent slopes. This map unit is on ridges and hillslopes. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Baux loam, 9 to 35 percent slopes, on ridges; 25 percent Bauxson channery loam,

9 to 60 percent slopes, on hillslopes and in saddles; and 20 percent Kirtley loam, 3 to 9 percent slopes, on hillslopes.

Included in this unit are small areas of Recluse loam, Harlan loam, and Cedak loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish gray loam about 1 inch thick. The lower 11 inches is reddish gray very channery loam. The underlying material to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 20 inches.

Permeability in the Baux soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is very low. The 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 Bauxson soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish gray channery loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 11 inches thick. The lower 5 inches is reddish brown very channery clay loam. The substratum to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Bauxson soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is very low. The 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 Kirtley soil is moderately deep and well drained. It formed in colluvium derived from shale. Typically, the surface layer is reddish brown loam about 4 inches thick. The upper 11 inches of the subsoil is reddish brown clay loam. The lower part is light reddish brown clay loam about 18 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, spike fescue, and western wheatgrass. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, blue grama, and shrubs increase. As the ecological condition further deteriorates, thistle and gumweed invade.

The potential plant community on the Bauxson soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Kirtley soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Baux soil is limited by droughtiness. The Bauxson and Kirtley soils have few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock to the Baux and Bauxson soils and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding generally is poor; however, small areas of the Kirtley soil on the gently sloping and moderately sloping lower parts of hillslopes are well suited to rangeland seeding. The main limitation affecting seeding in the steeper areas is the slope.

The Baux and Bauxson soils are in capability subclass VIIe, nonirrigated, and the Kirtley soil is in capability subclass IVe, nonirrigated. The Baux soil is in the Very Shallow, 15- to 19-inch precipitation zone, Northern Plains range site. The Bauxson soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Kirtley soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

111—Baux-Bauxson-Wetterdon association, 0 to 75 percent slopes. This map unit is on ridges, alluvial fans, and hillslopes. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Baux loam, 6 to 35 percent slopes; 30 percent Bauxson channery loam, 6 to 75 percent slopes; and 25 percent Wetterdon silt loam, 0 to 6 percent slopes. The Baux and Bauxson soils are on ridges, and the Wetterdon soil is on alluvial fans, foot slopes, and toe slopes.

Included in this unit are small areas of Kirtley loam, Harlan loam, and Recluse loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish gray loam about 1 inch thick. The lower 11 inches is reddish gray very channery loam. The underlying material to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 20 inches.

Permeability in the Baux soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is very low. The 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 Bauxson soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish gray channery loam about 2 inches thick. The upper part of the subsoil is reddish brown clay loam about 11 inches thick. The lower 5 inches is very channery clay loam. The substratum to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Bauxson soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is very low. The 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 Wetterdon soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rocks. Typically, the surface layer is dark brown silt loam about 13 inches thick. The upper 9 inches of the subsoil is dark reddish brown silt loam. The lower 19 inches is reddish brown clay loam. The substratum to a depth of 60 inches or more is yellowish brown loam.

Permeability is moderate in the Wetterdon soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, spike fescue, and western wheatgrass. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, blue grama, and shrubs increase. As the ecological condition further deteriorates, thistle and gumweed invade.

The potential plant community on the Bauxson soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Wetterdon soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the

ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Baux soil is limited by droughtiness. The Bauxson and Wetterdon soils have few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock to the Baux and Bauxson soils and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding generally is poor; however, small areas of the Wetterdon soil on the gently sloping toe slopes, foot slopes, and alluvial fans are well suited to rangeland seeding. The main limitation affecting seeding in the steeper areas is the slope.

The Baux and Bauxson soils are in capability subclass VIIe, nonirrigated, and the Wetterdon soil is in capability subclass IIIe, nonirrigated. The Baux soil is in the Very Shallow, 15- to 19-inch precipitation zone, Northern Plains range site. The Bauxson soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Wetterdon soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

112—Bidman-Arvada fine sandy loams, 0 to 6 percent slopes. This map unit is on alluvial fans and terraces. Areas are irregular and deltaic in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Bidman fine sandy loam and 35 percent Arvada 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 Zigweid loam, Absted fine sandy loam, and Slickspots. Included areas make up about 20 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 shale. Typically, the surface layer is light gray fine sandy loam about 4 inches thick. The upper 12 inches of the subsoil is brown clay. The next 10 inches is yellowish brown clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 gray fine sandy loam about 4 inches thick. The upper 10 inches of the subsoil is very strongly alkaline, brown clay. The next 6 inches is strongly alkaline, brown clay loam. The lower part to a depth of 60 inches or more is strongly alkaline, light yellowish brown clay loam.

Permeability is very slow in the Arvada soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The Bidman soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Arvada soil is limited by the alkalinity. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Bidman soil and poor on the Arvada soil. The main management concern affecting rangeland seeding on the Bidman soil is the hazard of wind erosion. The main limitations affecting rangeland seeding on the Arvada soil are the alkalinity and the hazard of wind erosion. These soils, however, are so intricately intermingled that seeding them separately would not be practical. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion.

The Bidman soil is in capability subclass IVe, nonirrigated, and the Arvada soil is in capability subclass VIs, nonirrigated. This map unit is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

113—Bidman-Arvada complex, moist, 0 to 3 percent slopes. This map unit is on alluvial fans and terraces. Areas are deltaic and irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Bidman loam and 35 percent Arvada 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 Zigweid loam, Absted fine sandy loam, and Slickspots. Included areas make up about 20 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 shale. Typically, the surface layer is pale brown loam about 2 inches thick. The upper 15 inches of the subsoil is brown clay. The next part is light brownish gray clay loam about 9 inches thick. The lower part to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 Arvada soil is very deep and well drained. It formed in alluvium derived from sodic shale. Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The upper 13 inches of the subsoil is very strongly alkaline, brown clay. The next 5 inches is strongly alkaline, yellowish brown clay. The lower part to a depth of 60 inches or more is strongly alkaline, pale brown clay loam.

Permeability is very slow in the Arvada soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of wind erosion is severe.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, western wheatgrass, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The Bidman soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Arvada soil is limited by the alkalinity. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good on the Bidman soil and poor on the Arvada soil. The main limitations affecting rangeland seeding on the Arvada soil are the alkalinity and the hazard of wind erosion. These soils, however, are so intricately intermingled that seeding them separately would not be practical.

The Bidman soil is in capability subclass IIIe, nonirrigated, and the Arvada soil is in capability subclass VIs, nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

114—Bidman-Ulm, dry, complex, 0 to 6 percent slopes. This map unit is on alluvial fans, terraces, and toe slopes. Areas are deltaic in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Bidman fine sandy loam and 35 percent Ulm 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 Absted fine sandy loam and Wyarno clay loam. Included areas make up about 10 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 shale. Typically, the surface layer is pale brown fine sandy loam about 4 inches thick. The upper 10 inches of the subsoil is light brownish gray clay loam. The next 12 inches is

pale brown clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 Ulm soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is light brownish gray loam about 3 inches thick. The upper 5 inches of the subsoil is light brownish gray clay loam. The next 11 inches is brown clay loam. The lower part to a depth of 60 inches or more is light olive brown and light yellowish brown clay loam. In some areas the surface layer is clay loam.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If this unit is used for irrigated crops, the main limitation is the slow permeability. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Early seeding of fall grain and stubble-mulch tillage can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Bidman soil and good on the Ulm soil. The main management concern affecting rangeland seeding on the Bidman soil is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

115—Bidman, moist-Ulm loams, 0 to 6 percent slopes. This map unit is on alluvial fans, terraces, and toe slopes. Areas are deltaic in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Bidman loam and 35 percent Ulm 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 Absted fine sandy loam and Wyarno clay loam. Included areas make up about 10 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 shale. Typically, the surface layer is pale brown loam about 2 inches thick. The upper 11 inches of the subsoil is yellowish brown clay loam. The next 9 inches is pale brown gray clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 Ulm soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the

surface layer is light brownish gray loam about 3 inches thick. The upper 5 inches of the subsoil is light brownish gray clay loam. The next 11 inches is brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown clay loam. In some areas the surface layer is clay loam.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Early seeding of fall grain and stubble-mulch tillage can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

116—Big Horn-Wolf, dry, loams, 0 to 6 percent slopes. This map unit is on outwash terraces and fan terraces. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Big Horn loam and 35 percent Wolf 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 Bidman loam, Ulm loam, and Forkwood loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Big Horn soil is very deep and well drained. It formed in alluvium derived from shale over outwash material. Typically, the surface layer is grayish brown loam about 5 inches thick. The upper 12 inches of the subsoil is pale brown clay. The next 13 inches is light brownish gray clay. The lower part to a depth of 60 inches or more is white gravelly loam and gravelly clay loam. In some areas the layer below a depth of 40 inches is extremely gravelly sand. Depth to the gravelly layers ranges from 20 to 40 inches. In cultivated areas the surface layer is clay loam.

Permeability is slow in the Big Horn soil. Available water capacity is high. The 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 Wolf soil is very deep and well drained. It formed in alluvium derived from shale over outwash material. Typically, the surface layer is grayish brown loam about 4 inches thick. The upper part of the subsoil is brown clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is white gravelly clay loam. Depth to the gravelly layer ranges from 10 to 20 inches.

Permeability is moderate in the Wolf soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If this unit is used for irrigated crops, the main limitation is the slow permeability in the Big Horn soil. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

117—Cambria-Forkwood complex, 0 to 15 percent slopes. This map unit is on alluvial fans, terraces, and hillslopes. Areas are deltaic in shape and are 10 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 60 percent Cambria very fine sandy loam and 30 percent Forkwood 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, Zigweid loam, and Cushman loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Cambria soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 5 inches thick. The upper 5 inches of the subsoil is brown silty clay loam. The next 5 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is very pale brown loam. In some areas the surface layer is loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 Forkwood soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown fine sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown clay loam about 11 inches thick. The lower part to a depth of 60 inches or more is very pale brown loam. In some areas the surface layer is loam.

Permeability is moderate in the Forkwood soil. Available water capacity is high. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the low annual precipitation and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama,

and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

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

118—Cambria-Forkwood complex, moist, 0 to 9 percent slopes. This map unit is on alluvial fans, terraces, and hillslopes. Areas are deltaic in shape and are 10 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Cambria very fine sandy loam and 35 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 Kishona loam and Recluse loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Cambria soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown clay loam about 7 inches thick. The next part is light yellowish brown clay loam about 4 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown loam. In cultivated areas this soil has a darker surface layer, a clay loam surface layer, or both.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 Forkwood soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 19 inches thick. The lower part to a depth of 60 inches or more is pale yellow loam. In cultivated areas this soil has a darker surface layer, a clay loam surface layer, or both.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

119—Cedak-Recluse association, 3 to 6 percent slopes. This map unit is on hillslopes, terraces, and alluvial fans. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Cedak fine sandy loam on terraces and the upper part of hillslopes and 40 percent Recluse loam on terraces, alluvial fans, and the lower part of hillslopes.

Included in this unit are small areas of Nuncho loam, Platmak loam, Wetterdon loam, and Moskee sandy loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Cedak soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown fine sandy loam about 2 inches thick. The upper 2 inches of the subsoil is brown loam. The next 13 inches is brown clay loam. The lower part is light yellowish brown loam about 7 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Cedak soil. Available water capacity is low. The 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 Recluse soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 6 inches thick. The upper 13 inches of the subsoil is dark grayish brown clay loam. The next 8 inches is dark yellowish brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown clay loam. In some areas the surface layer is fine sandy loam and the subsoil is loam.

Permeability is moderate in the Recluse soil. Available water capacity is high. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Cedak soil and the hazard of wind erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain and stubble-mulch tillage can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the

hazard of wind erosion. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

The Cedak soil is in capability subclass IVe, nonirrigated, and the Recluse soil is in capability subclass IIIe, nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

120—Cedak-Recluse association, 6 to 9 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Cedak loam on the upper part of hillslopes and 40 percent Recluse loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Nuncho loam, Moskee sandy loam, Platmak loam, and Emigrant loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Cedak soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown loam about 4 inches thick. The upper 15 inches of the subsoil is pale brown clay loam. The next 5 inches is light gray clay loam. The lower part is light gray loam about 6 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Cedak soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also 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 about 3 inches thick. The upper 11 inches of the subsoil is dark brown loam. The next 16 inches is brown clay loam. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Cedak soil and the hazards of wind and water erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

121—Cedak-Recluse association, 9 to 15 percent slopes. This map unit is on hills, terraces, and alluvial fans. Areas are irregular in shape and are 20 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Cedak loam on hillcrests and the upper part of hillslopes and 35 percent Recluse loam on terraces, alluvial fans, and the lower part of hillslopes.

Included in this unit are small areas of Nuncho loam, Moskee sandy loam, and Worf loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Cedak soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 1 inch thick. The upper part of the subsoil is dark brown clay loam about 15 inches thick. The next 4 inches is very pale brown loam. The lower part is light gray very fine sandy loam about 11 inches thick over weakly consolidated sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Cedak soil. Available water capacity also is moderate. The 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.

The Recluse soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark grayish brown loam about 4 inches thick. The upper 14 inches of the subsoil is grayish brown clay loam. The next 22 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

122—Cedak-Recluse association, dry, 3 to 15 percent slopes. This map unit is on terraces, alluvial fans, and hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is about 110 to 120 days.

This unit is 45 percent Cedak loam on alluvial fans, hillcrests, and the upper part of hillslopes and 40 percent Recluse loam on alluvial fans, terraces, and the lower part of hillslopes.

Included in this unit are small areas of Forkwood loam, Moskee sandy loam, and Shingle loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Cedak soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 2 inches thick. The upper 8 inches of the subsoil is brown loam. The next 6 inches is brown clay loam. The lower part is pale brown silty

clay loam about 16 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

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

The Recluse soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 5 inches thick. The upper 10 inches of the subsoil is dark brown clay loam. The next 8 inches is pale brown clay loam. The next part to a depth of 42 inches is pale brown silty clay loam. The lower part to a depth of 60 inches or more is light yellowish brown loam. In some areas the surface layer is fine sandy loam and the subsoil is loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the low annual precipitation and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

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

123—Clarkelen loam, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on high flood plains and low terraces adjacent to perennial drainageways. It formed in alluvium derived from sedimentary rock. Areas are elongated and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Haverdad fine sandy loam and Kishona loam. Also included are areas of soils that are subject to occasional flooding. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is pale brown loam about 9 inches thick. The upper 17 inches of the underlying material is pale brown fine sandy loam thinly stratified with textures ranging from loamy sand to clay loam. The lower part to a depth of 60 inches or more is brown loamy coarse sand thinly stratified with textures ranging from loamy sand to clay loam. In some areas gravel is present below a depth of 40 inches.

Permeability is moderately rapid in the Clarkelen soil. Available water capacity is high. The 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 subject to rare flooding.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness and the low annual precipitation. If used for irrigated crops, this unit has few limitations. Returning crop residue to the soil or

regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly needleandthread, blue grama, western wheatgrass, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

124—Clarkelen fine sandy loam, moist, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on flood plains and low terraces adjacent to perennial drainageways. It formed in alluvium derived from interbedded sedimentary rock. Areas are elongated and are 15 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Havertel silt loam and Haverdad fine sandy loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown fine sandy loam about 10 inches thick. The upper 25 inches of the underlying material is stratified pale brown fine sandy loam and loam. The lower part to a depth of 60 inches or more is stratified very pale brown loam, sandy loam, and loamy sand. In some areas the layer below a depth of 40 inches is gravelly loamy sand or cobbly loamy sand. In other areas the surface layer is loam.

Permeability is moderately rapid in the Clarkelen soil. Available water capacity is high. The 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 rare flooding. Channeling and deposition are common along streambanks.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazard of wind erosion and droughtiness. If this unit is used for irrigated crops, the main management concern is the hazard of wind erosion. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, green needlegrass, spike fescue, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern is the hazard of wind

erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

125—Cloud Peak-Tolman complex, 10 to 75 percent slopes. This map unit is on mountain slopes and ridges (fig. 4). Areas are irregular in shape and are 150 to 300 acres in size. The native vegetation consists of areas of coniferous trees and an understory of grasses and areas dominated by grasses. The canopy cover on the Cloud Peak soil is 75 to 100 percent. Elevation is 5,400 to 7,000 feet. The average annual precipitation is 18 to 20 inches, the average annual temperature is 41 to 43 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 40 percent Cloud Peak gravelly silt loam, 10 to 75 percent slopes, and 30 percent Tolman channery loam, 10 to 70 percent 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 Agneston gravelly sandy loam, Granile gravelly sandy loam, and areas of limestone rock outcrop. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Cloud Peak soil is moderately deep and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface is covered with a layer of organic litter 3 inches thick. The surface layer is brown gravelly silt loam about 2 inches thick. The upper 12 inches of the subsoil is light yellowish

Figure 4.—An area of Cloud Peak-Tolman complex, 10 to 75 percent slopes.

brown very gravelly silty clay loam. The next 7 inches is pale brown very cobbly silty clay loam. The lower part is very pale brown extremely cobbly silt loam about 16 inches thick over limestone. Depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Cloud Peak soil. Available water capacity is low. The 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 slight.

The Tolman soil is shallow and well drained. It formed in residuum and colluvium derived from limestone and sandstone. Typically, the surface layer is dark grayish brown channery loam about 5 inches thick. The upper part of the subsoil is dark grayish brown very channery clay loam about 6 inches thick. The lower part is dark brown very channery clay loam about 4 inches thick over hard, cherty limestone. Depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Tolman soil. Available water capacity is very low. The 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.

This unit is used for wildlife habitat and livestock grazing.

The plant community on the Cloud Peak soil is mainly Douglas-fir, Engelmann spruce, ponderosa pine, and limber pine with an understory of Saskatoon serviceberry, Oregongrape, common juniper, heartleaf arnica, and bedstraw.

The potential plant community on the Tolman soil is Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Cloud Peak soil is limited by the dense canopy cover. The production of vegetation suitable for livestock grazing on the Tolman soil is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Tolman soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site. The Cloud Peak soil is a woodland site.

126—Coaliams-Worthenton, moist, complex, 0 to 3 percent slopes. This map unit is on flood plains and low terraces adjacent to perennial streams. Areas are elongated and sinuous in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses, shrubs, and deciduous trees. The canopy cover is 10 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Coaliams loam on low terraces and flood plains and 40 percent Worthenton silty clay loam in depressions and oxbows on flood plains.

Included in this unit are small areas of Haverdad loam, Havertel loam, and Clarkelen fine sandy loam. Also included along Meade Creek are areas of a soil that is similar to the Coaliams soil but has a layer of sand and gravel at a depth of 40 to 60 inches. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Coaliams soil is very deep and moderately well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil to a depth of 60 inches or more is brown and grayish brown loam stratified with sandy loam and clay loam.

Permeability is moderate in the Coaliams soil. Available water capacity is high. The 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 rare flooding. A high water table is at a depth of 3.5 to 6.0 feet from May through September.

The Worthenton soil is very deep and poorly drained. It formed in alluvium derived from sedimentary rock. Typically, the surface is covered with an organic mat 3 inches thick. The surface layer is very dark gray silty clay loam about 8 inches thick. The upper part of the subsoil is dark grayish brown silty clay about 14 inches thick. The lower part to a depth of 60 inches or more is olive gray silty clay and clay. In some areas the lower part of the subsoil is clay loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 60 inches or more for water-tolerant plants and 6 to 18 inches for plants that are not tolerant of

a high water table. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to occasional flooding for brief periods from March through June. A fluctuating high water table is at a depth of 0.5 foot to 1.5 feet from March through July and at a depth of 1.5 to 3.0 feet the rest of the year.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

The Coaliams soil has few limitations affecting the production of plants suitable for hay and pasture. The production of plants suitable for hay and pasture on the Worthenton soil is limited by the shallow depth to the water table. Irrigation water needs to be applied carefully to prevent the buildup of the water table.

The potential plant community on the Coaliams soil is mainly green needlegrass, western wheatgrass, basin wildrye, Columbia needlegrass, Canada wildrye, slender wheatgrass, and cottonwood. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years, 3,000 pounds in favorable years, and 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, wild plum, and chokecherry increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

The potential plant community on the Worthenton soil is mainly Nebraska sedge, bluejoint reedgrass, northern reedgrass, tufted hairgrass, and willows. The potential plant community produces about 6,000 pounds of air-dry vegetation per acre in normal years, 7,000 pounds in favorable years, and 4,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge, inland sedge, Baltic rush, and willows increase. As the ecological condition further deteriorates, annuals and cocklebur invade.

The Coaliams soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worthenton soil is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability for rangeland seeding is good on the Coaliams soil and poor on the Worthenton soil. The main limitation affecting rangeland seeding on the Worthenton soil is the wetness.

The Coaliams soil is in capability subclass IIIe, irrigated and nonirrigated, and the Worthenton soil is in capability subclass VIw, irrigated and nonirrigated. The Coaliams soil is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worthenton soil is in the Wetland, 15- to 19-inch precipitation zone, Northern Plains range site.

127—Cushman-Forkwood association, 3 to 15 percent slopes. This map unit is on hills and terraces. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Cushman very fine sandy loam, 6 to 15 percent slopes, on hillcrests and the upper part of hillslopes and 35 percent Forkwood loam, 3 to 10 percent slopes, on terraces and the lower part of hillslopes.

Included in this unit are small areas of Shingle loam, Worf loam, Cambria loam, and shallow, clayey soils. 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 interbedded sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The upper 12 inches of the subsoil is brown and yellowish brown clay loam. The next 7 inches is pale brown clay loam. The lower part is white loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Cushman soil. Available water capacity also is moderate. The 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 Forkwood soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 3 inches thick. The upper part of the subsoil is brown clay loam about 15 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is clay loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are droughtiness and the hazard of wind erosion on the Cushman soil and the hazard of water erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and wind erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of the soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. If the existing plant cover is removed during the period of seeding, the main management concerns affecting rangeland seeding are the hazards of wind and water erosion. A cover crop is needed to minimize the hazard of erosion.

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

128—Cushman-Forkwood association, moist, 0 to 9 percent slopes. This map unit is on hillslopes, alluvial fans, and terraces. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Cushman loam, 3 to 9 percent slopes, on the upper part of hillslopes and 40 percent Forkwood loam, 0 to 9 percent slopes, on alluvial fans, terraces, and the lower part of hillslopes.

Included in this unit are small areas of Worf loam, Cambria loam, and Recluse 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 interbedded sedimentary rock. Typically, the surface layer is light brownish gray loam about 1 inch thick. The upper 13 inches of the subsoil is brown clay loam. The next 11 inches is light gray clay loam. The lower part is light gray loam about 13 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

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

The Forkwood soil is very deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rocks. Typically, the surface layer is brown loam about 4 inches thick. The upper part of the subsoil is yellowish brown clay loam about 13 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

Permeability is moderate in the Forkwood soil. Available water capacity is high. The 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 mainly for livestock grazing and wildlife habitat. It is also used for irrigated and nonirrigated crops.

If this unit is used for crops, the main limitations are droughtiness in the Cushman soil and the hazard of water erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and water erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching

of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly spike fescue, Idaho fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

The Cushman soil is in capability subclass IVe, nonirrigated and irrigated, and the Forkwood soil is in capability subclass IIIe, irrigated and nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

129—Cushman-Forkwood association, moist, 9 to 15 percent slopes. This map unit is on terraces and hills. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Cushman loam on hillcrests and the upper part of hillslopes and 30 percent Forkwood loam on terraces and the lower part of hillslopes.

Included in this unit are small areas of Worf loam, Bowbac sandy loam, and Cambria 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 interbedded sedimentary rock. Typically, the surface layer is brown loam about 5 inches thick. The upper part of the subsoil is yellowish brown clay loam about 8 inches thick. The lower part is very pale brown loam about 21 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Cushman soil. Available water capacity also is moderate. The 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.

The Forkwood soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is dark grayish brown loam about 1 inch thick. The upper part of the subsoil is dark yellowish brown clay loam about 12 inches thick. The lower part to a depth of 60 inches or more is light gray loam. In some areas the surface layer is fine sandy loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Cushman soil and the hazard of water erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly spike fescue, Idaho fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair.

The main management concern affecting rangeland seeding is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

130—Cushman-Worf association, 3 to 25 percent slopes. This map unit is on terraces and hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Cushman loam, 3 to 15 percent slopes, on terraces and hillslopes, and 30 percent Worf loam, 3 to 25 percent slopes, on hillcrests.

Included in this unit are small areas of Shingle clay loam, Theedle loam, and Forkwood loam. Included areas make up about 30 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 residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper part of the subsoil is brown clay loam about 11 inches thick. The lower part is pale yellow clay loam about 14 inches thick over soft shale. In some areas the surface layer is fine sandy loam or silty clay loam. Depth to bedrock ranges from 20 to 40 inches.

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

The Worf soil is shallow and well drained. It formed in residuum derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper part of the subsoil is dark yellowish brown clay loam about 5 inches thick. The lower part is brown clay loam about 13 inches thick over soft shale. In some areas the surface layer is fine sandy loam. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Worf soil. Available water capacity is very low. The 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 mainly for livestock grazing and wildlife habitat. In some areas the Cushman soil is also used for nonirrigated crops.

If the Cushman soil is used for nonirrigated crops, the main limitations are droughtiness, the low annual precipitation, and the hazard of water erosion. The Worf soil is not suited to cropland because of droughtiness and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Tillage should be on the contour or across the slope.

The potential plant community on the Cushman soil is mainly western wheatgrass, green needlegrass, needleandthread, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

The potential plant community on the Worf soil is mainly western wheatgrass, bluebunch wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The Cushman soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worf soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Cushman soil and poor on the Worf soil. The main management concern affecting seeding is the hazard of water erosion. These soils, however, are so intricately intermingled that seeding them separately may not be practical. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Cushman soil is in capability subclass IVe, nonirrigated, and the Worf soil is in capability subclass VIe, nonirrigated. The Cushman soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Worf soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

131—Cushman-Worf association, moist, 3 to 15 percent slopes. This map unit is on terraces and hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Cushman loam on terraces and hillslopes and 35 percent Worf loam on hillcrests.

Included in this unit are small areas of Shingle clay loam, Theedle loam, Worfka fine sandy loam, and Parmleed fine sandy loam. Included areas make up about 25 percent of the total acreage.

The Cushman soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 3 inches thick. The upper part of the subsoil is yellowish brown clay loam about 8 inches thick. The lower part is very pale brown loam about 27 inches thick over soft shale. Depth to bedrock is 20 to 40 inches.

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

The Worf soil is shallow and well drained. It formed in residuum derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 4 inches thick. The lower part is pale brown loam about 7 inches thick over soft shale. Depth to bedrock is 10 to 20 inches. In some areas the surface layer is fine sandy loam or silt loam.

Permeability is moderate in the Worf soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used mainly for livestock grazing and wildlife habitat. In a few areas the Cushman soil is also used for nonirrigated crops.

If the Cushman soil is used for nonirrigated crops, the main limitations are droughtiness, the low annual precipitation, and the hazard of water erosion. The Worf soil is not suited to cropland because of droughtiness. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Tillage should be on the contour or across the slope.

The potential plant community on the Cushman soil is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Worf soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing on the Worf soil is limited by droughtiness and the rooting depth. The Cushman soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Cushman soil and poor on the Worf soil. The main management concern affecting seeding is the hazard of water erosion. The droughtiness of the Worf soil is also a limitation. These soils, however, are so intricately intermingled that seeding them separately may not be practical. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Cushman soil is in capability subclass IVe, nonirrigated, and the Worf soil is in capability subclass VIe, nonirrigated. The Cushman soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worf soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

132—Dast Variant loamy fine sand, 30 to 65 percent slopes. This shallow, excessively drained soil is on ridges. It formed in residuum derived from sandstone. The native vegetation is mainly coniferous trees, shrubs, and forbs. The canopy cover is 75 to 100 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of sandstone outcrop and soils that are similar to the Dast Variant soil but have bedrock at a depth of 20 to 40 inches. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface is covered with a layer of undecomposed forest litter 1 inch thick. The surface layer is brown loamy fine sand 9 inches thick. The underlying material is brown loamy fine sand about 11 inches thick over hard, fractured sandstone. Depth to bedrock is 10 to 20 inches.

Permeability is rapid in the Dast Variant soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used for wildlife habitat.

The plant community is mainly Douglas-fir, Engelmann spruce, ponderosa pine, and limber pine with an understory of Saskatoon serviceberry, Oregongrape, common juniper, heartleaf arnica, and bedstraw. The production of vegetation suitable for livestock grazing is limited by the canopy cover.

This map unit is in capability subclass VIIe, nonirrigated, and is a woodland site.

133—Doney-Doney Variant complex, 6 to 75 percent slopes. This map unit is on hillslopes and ridges. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Doney silt loam, 6 to 45 percent slopes, and 30 percent Doney Variant loam, 8 to 75 percent 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 Dast sandy loam, Wayden silty clay, and shale and sandstone outcrops. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Doney soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown silt loam about 3 inches thick. The upper 13 inches of the subsoil is pale brown silty clay loam. The lower part is light brownish gray silty clay loam about 7 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Doney soil. Available water capacity is low. The 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 Doney Variant soil is shallow and well drained. It formed in residuum and colluvium derived from interbedded sedimentary rocks. Typically, the surface layer is pale brown loam about 1 inch thick. The upper 8 inches of the subsoil is brown loam. The lower part is yellowish brown loam about 8 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Doney Variant soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Doney soil is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Doney Variant soil is Idaho fescue, bluebunch wheatgrass, little bluestem, needleandthread, and green needlegrass. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in unfavorable years to 1,800 pounds in favorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Doney soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Doney Variant soil is limited by droughtiness and the rooting depth. The slope limits access by livestock

and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Doney soil is in capability subclass VIe, nonirrigated, and the Doney Variant soil is in capability subclass VIIe, nonirrigated. The Doney soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Doney Variant soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

134—Doney-Ringling association, 8 to 90 percent slopes. This map unit is on ridges and valley sides. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Doney silt loam, 25 to 90 percent slopes, on shoulders and side slopes and 30 percent Ringling channery loam, 8 to 75 percent slopes, on ridgecrests.

Included in this unit are small areas of Arnegard loam, Doney Variant loam, Reeder loam, and shale and porcellanite outcrops and small areas of wet soils in narrow drainageways. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Doney soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown silt loam about 2 inches thick. The upper 9 inches of the subsoil is pale brown loam. The lower part is very pale brown loam about 16 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Doney soil. Available water capacity is low. The 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 Ringling soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish brown channery loam about 4 inches thick. The lower 8 inches is reddish brown very channery loam. The underlying material to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to fractured porcellanite material is 10 to 20 inches.

Permeability in the Ringling soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is very low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Doney soil is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Ringling soil is Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in unfavorable years to 1,800 pounds in favorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Doney soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Ringling soil is limited by droughtiness and the rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Doney soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Ringling soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

135—Doney-Ringling-Rock outcrop complex, 15 to 70 percent slopes. This map unit is on ridges and valley sides. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free season is 80 to 100 days.

This unit is 30 percent Doney loam, 20 to 70 percent slopes; 30 percent Ringling channery loam, 15 to 70 percent slopes; and 20 percent areas of shale and porcellanite 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 Doney Variant loam, Searing loam, Reeder loam, and Wayden silty clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Doney soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is very pale brown loam about 2 inches thick. The upper 10 inches of the subsoil is pale brown loam. The lower part is very pale brown loam about 21 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Doney soil. Available water capacity is low. The 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 Ringling soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is brown channery loam about 4 inches thick. The lower 8 inches is brown very channery loam. The underlying material to a depth of 60 inches or more is fractured and displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to fractured porcellanite material is 10 to 20 inches.

Permeability in the Ringling soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is very low. The 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 areas of Rock outcrop consist of exposures of shale and porcellanite.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Doney soil is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Ringling soil is Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in unfavorable years to 1,800 pounds in favorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Doney soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Ringling soil is limited by droughtiness and the rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Doney and Ringling soils are in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Doney soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Ringling soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

136—Draknab loamy fine sand, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on flood plains and low terraces. It formed in alluvium derived from sandstone. Areas are elongated and are 5 to 20 acres in size. The native vegetation is mainly grasses, shrubs, and deciduous trees. The canopy cover is 0 to 10 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Haverdad very fine sandy loam. Included areas make up about

25 percent of the total acreage. The percentage varies from one area to another.

Typically, the upper 3 inches of the surface layer is brown loamy fine sand. The lower 7 inches is brown loamy sand. The underlying material to a depth of 60 inches or more is pale brown sand stratified with a few very thin lenses of sandy loam.

Permeability is rapid in the Draknab soil. Available water capacity is low. The 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 rare flooding.

This unit is used for irrigated hay and pasture, livestock grazing, and wildlife habitat.

If this unit is used for irrigated hay and pasture, the main limitations are the rapid permeability and the low available water capacity. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, and slender wheatgrass. 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. As the ecological condition deteriorates, silver sagebrush, rubber rabbitbrush, and snowberry increase. As the ecological condition further deteriorates, annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Lowland, 10- to 14-inch precipitation zone, Northern Plains range site.

137—Farnuf loam, 0 to 6 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the frost-free period is 80 to 100 days.

Included in this unit are small areas of Savar silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The upper part of the subsoil is grayish brown clay loam about 12 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Permeability is moderate in the Farnuf soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the short growing season. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants

decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

138—Farnuf loam, 6 to 9 percent slopes. This very deep, well drained soil is on hillslopes and alluvial fans. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the frost-free period is 80 to 100 days.

Included in this unit are small areas of Savar silt loam and Twin Creek loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The upper 15 inches of the subsoil is yellowish brown clay loam. The next 7 inches is yellowish brown clay loam. The lower part to a depth of 60 inches or more is yellowish brown loam.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazard of water erosion and the short growing season. The slope is also a limitation affecting irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is western wheatgrass, Idaho fescue, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

139—Farnuf loam, 9 to 15 percent slopes. This very deep, well drained soil is on hillslopes and alluvial fans. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Savar silt loam, Twin Creek loam, and Reeder loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The upper 14 inches of the subsoil is brown clay loam. The next 7 inches is grayish brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern affecting seeding is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

140—Farnuf Variant loam, wet, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on terraces adjacent to perennial streams. It formed in alluvium derived from sedimentary rock over alluvium derived from granite. Areas are sinuous in shape and elongated and are 10 to 25 acres in size. The native vegetation is mainly coniferous trees, shrubs, grasses, and forbs. The canopy cover is 75 to 95 percent. Elevation is 4,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of soils that have granitic stones and boulders on the surface and areas of Assinniboine Variant sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface is covered with a layer of decomposed pine needles 1 inch thick. The surface layer is dark grayish brown loam about 10 inches thick. The subsoil is dark yellowish brown clay loam about 30 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand.

Permeability is moderately slow in the Farnuf Variant soil. Available water capacity is high. The effective rooting depth is 60 inches or more for water-tolerant plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating water table is at a depth of 1 foot to 3 feet from May through October.

This unit is used mainly for livestock grazing and wildlife habitat.

The plant community is mainly ponderosa pine with an understory of common chokecherry, black hawthorn, silver buffaloberry, Kentucky bluegrass, and slender wheatgrass. The production of vegetation suitable for livestock grazing is limited by the canopy cover.

This map unit is in capability subclass IVw, nonirrigated, and is a woodland site.

141—Farnuf Variant-Cloud Peak Variant complex, 0 to 6 percent slopes. This map unit is on terraces. Areas are elongated and irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses, forbs, and ponderosa pine. Elevation is 4,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 55 percent Farnuf Variant silt loam and 30 percent Cloud Peak Variant 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 Assinniboine Variant sandy loam and soils that are similar to the Farnuf Variant soil but have a thicker surface layer and a clayey subsoil. Also included are soils that are similar to the Farnuf Variant soil but are somewhat poorly drained. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Farnuf Variant soil is very deep and well drained. It formed in alluvium derived from shale over

alluvium derived from granite. Typically, the surface layer is dark gray silt loam about 10 inches thick. The subsoil is brown clay loam about 30 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand.

Permeability is moderately slow in the Farnuf Variant soil. Available water capacity is high. The 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 Cloud Peak Variant soil is very deep and well drained. It formed in alluvium derived from shale over alluvium derived from granite. Typically, the surface is covered with a layer of partly decomposed pine needles 1 inch thick. The surface layer is dark grayish brown very fine sandy loam about 4 inches thick. The subsurface layer is pale brown loamy sand about 7 inches thick. The subsoil is brown sandy clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand.

Permeability in the Cloud Peak Variant soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Farnuf Variant soil is mainly Idaho fescue, green needlegrass, spike fescue, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in unfavorable years to 3,000 pounds in favorable years.

The plant community on the Cloud Peak Variant soil is mainly ponderosa pine with an understory of common chokecherry, black hawthorn, silver buffaloberry, green needlegrass, Idaho fescue, and slender wheatgrass. The production of the plant community in normal years ranges from 500 pounds of air-dry vegetation per acre in areas that have a dense overstory to 1,500 pounds per acre in areas that have a sparse understory.

The Farnuf Variant soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Cloud Peak Variant soil is limited by the canopy cover. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good on the Farnuf Variant soil and fair on the Cloud Peak Variant soil. The main management concern affecting seeding on the Cloud Peak Variant soil is the hazard of wind erosion. Seeding the Cloud Peak Variant soil is not practical because of the canopy cover.

This map unit is in capability subclass IVe, nonirrigated. The Farnuf Variant soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Cloud Peak Variant soil is a woodland site.

142—Forkwood loam, 0 to 3 percent slopes. This very deep, well drained soil is on fans and terraces. It formed in alluvium derived from sedimentary rock. Areas are deltaic in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of soils along the Powder River that are similar to the Forkwood soil but have a subsoil of sandy clay loam or silt loam at a depth of 30 to 40 inches. Also included are areas of Cambria loam and Wyarno clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray loam about 8 inches thick. The upper 10 inches of the subsoil is grayish brown clay loam. The next 5 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is light gray clay loam. In uncultivated areas the surface layer is fine sandy loam. In cultivated areas the surface layer is commonly clay loam.

Permeability is moderate in the Forkwood soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. It has few limitations affecting irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not

protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

143—Forkwood loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from sedimentary rock. Areas are deltaic in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Cambria loam and Wyarno clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is pale brown loam about 3 inches thick. The upper 10 inches of the subsoil is brown clay loam. The next 5 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is pale brown loam. In cultivated areas the surface layer is clay loam.

Permeability is moderate in the Forkwood soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. It has few limitations affecting irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain and stubble-mulch tillage can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

144—Forkwood loam, 6 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium and colluvium derived from sedimentary rock. Areas are deltaic in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Cambria loam, Zigweid loam, and Wyarno clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is pale brown loam about 4 inches thick. The upper part of the subsoil is brown clay loam about 15 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In cultivated areas the surface layer is clay loam.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the low annual precipitation and the hazard of water erosion. If this unit is used for irrigated crops, the main management concerns are the hazard of water erosion and the slope. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

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

145—Gayhart-Bahl association, 6 to 30 percent slopes. This map unit is on alluvial fans and hills. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Gayhart clay loam, 6 to 30 percent slopes, on hillcrests and the upper part of hillslopes and 30 percent Bahl clay loam, 6 to 15 percent slopes, on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Samday clay loam, Hilight clay loam, and Shingle loam. Also included in this unit are small areas of noncalcareous, very deep, clayey soils in the Leiter area. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Gayhart soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light olive brown clay loam about 10 inches thick. The underlying material is light yellowish brown clay about 26 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Gayhart soil. Available water capacity is moderate. The 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 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 about 3 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay. In some areas the surface layer is clay.

Permeability is slow in the Bahl soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for livestock grazing and wildlife habitat. In some areas the Bahl soil is also used for nonirrigated crops.

The Gayhart soil is not suited to cropland because of the slope. If the Bahl soil is used for nonirrigated crops, the main limitations are the clay loam surface layer, the hazard of water erosion, and the slight salinity of the soil. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. A tillage pan forms easily if the Bahl soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is poor on the Gayhart soil and fair on the Bahl soil. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland that have a slope of less than 15 percent. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

The Gayhart soil is in capability subclass VIe, nonirrigated, and the Bahl soil is in capability subclass IVe, nonirrigated. This map unit is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

146—Gayhart-Bahl association, moist, 6 to 15 percent slopes. This map unit is on alluvial fans and hills. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Gayhart clay loam on hillcrests and the upper part of hillslopes and 30 percent Bahl clay loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Samday clay loam, Hilight clay loam, and Shingle loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Gayhart soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 3 inches thick. The underlying material is light brownish gray clay about 21 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Gayhart soil. Available water capacity is low. The 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.

The Bahl soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is very pale brown clay loam about 3 inches thick. The underlying material to a depth of 60 inches or more is light olive brown clay. In some areas the surface layer is clay.

Permeability is slow in the Bahl soil. Available water capacity is high. The effective rooting depth is 60

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer, the hazard of water erosion, and the slight salinity of the soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern affecting seeding is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

147—Hardhart-Starley association, 10 to 60 percent slopes. This map unit is on mountain dip slopes and hills. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,500 to 7,500 feet. The average annual precipitation is 19 to 25 inches, the average annual temperature is 40 to 42 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 45 percent Hardhart very gravelly silt loam, 10 to 50 percent slopes, on dip slopes, hillcrests, and the lower part of hillslopes and 35 percent Starley loam, 10 to 60 percent slopes, on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Bynum loam and soils that are similar to the Hardhart soil but have a light colored surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Hardhart soil is moderately deep and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is dark brown very gravelly silt loam about 8 inches thick. The subsoil is light yellowish brown very gravelly loam about 19 inches thick over limestone. Depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Hardhart soil. Available water capacity is very low. The 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 slight.

The Starley soil is shallow and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is brown loam about 9 inches thick. The subsoil is yellowish brown very cobbly loam about 8 inches thick over limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Starley soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Hardhart soil is Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. A canopy cover of ponderosa pine ranges from 5 to 15 percent in most areas. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the

ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Starley soil is Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. A canopy cover of ponderosa pine ranges from 5 to 15 percent in most areas. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Hardhart soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Starley soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

148—Hargreave-Moskee association, 3 to 9 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Hargreave sandy loam on the ridges and the upper part of hillslopes and 30 percent Moskee sandy loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Noden sandy loam and Hiland sandy loam. Included areas make up about 25 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 residuum and alluvium derived from sandstone. Typically, the surface layer is dark brown sandy loam about 2 inches thick. The upper part of the subsoil is dark yellowish brown sandy clay loam about 17 inches thick. The lower part is yellowish brown sandy clay loam about 16 inches thick over sandstone. Bedrock is at a depth of 20 to 40 inches.

Permeability is moderate in the Hargreave soil. Available water capacity also is moderate. The 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 Moskee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark brown sandy loam about 6 inches thick. The upper 12 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 11 inches is yellowish brown sandy loam. The substratum to a depth of 60 inches or more is light gray sandy loam. In cultivated areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. The slope is also a limitation if the unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly prairie sandreed, sand bluestem, needleandthread, western wheatgrass, and little bluestem. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop should be used to minimize the hazard of wind erosion. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

The Hargreave soil is in capability subclass IVe, irrigated and nonirrigated, and the Moskee soil is in capability subclass IIIe, irrigated and nonirrigated. This map unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

149—Hargreave-Moskee association, 9 to 15 percent slopes. This map unit is on alluvial fans and hills. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Hargreave fine sandy loam on the upper part of hillslopes and 30 percent Moskee fine sandy loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Noden sandy loam. Included areas make up about 25 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 residuum and alluvium derived from sandstone. Typically, the surface layer is dark brown fine sandy loam about 4 inches thick. The upper part of the subsoil is brown sandy clay loam about 12 inches thick. The lower part is pale brown sandy clay loam about 18 inches thick over soft sandstone and shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam or sandy clay loam.

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

The Moskee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The upper 8 inches of the subsoil is dark grayish brown sandy clay loam. The next 9 inches is brown sandy clay loam. The lower 8 inches is pale brown sandy loam. The substratum to a depth of 60 inches or more is pale brown sandy loam. In cultivated areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazards of wind and water erosion. The slope is also a limitation if the unit is used for irrigated crops. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly prairie sandreed, sand bluestem, needleandthread, western wheatgrass, and little bluestem. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be

managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

150—Hargreave-Moskee association, dry, 3 to 15 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Hargreave sandy loam, 6 to 15 percent slopes, on hillcrests and the upper part of hillslopes and 35 percent Moskee sandy loam, 3 to 9 percent slopes, on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Bowbac sandy loam and Hiland sandy loam. Included areas make up about 15 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 residuum and alluvium derived from sandstone. Typically, the surface layer is brown sandy loam about 3 inches thick. The upper 9 inches of the subsoil is brown sandy clay loam. The next 4 inches is pale brown sandy clay loam. The lower part is light gray fine sandy loam about 9 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam or sandy clay loam.

Permeability is moderate in the Hargreave soil. Available water capacity is low. The 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 Moskee soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown sandy loam about 4 inches thick. The upper 12 inches of the subsoil is brown sandy clay loam. The lower 21 inches is pale brown sandy clay loam. The substratum to a depth of 60 inches or more is light brownish gray sandy loam. In cultivated areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazards of wind and water erosion and the low annual precipitation. The slope is also a limitation if this unit is used for irrigated crops. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, little bluestem, and Indian ricegrass. 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. As the ecological condition deteriorates, fringed sagewort, blue grama, yucca, and cudweed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is

needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

151—Harlan loam, dry, 0 to 15 percent slopes. This very deep, well drained soil is on alluvial fans, toe slopes of valley sides, and hillslopes. It formed in alluvium derived from porcellanite and shale. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Platmak loam and Wibaux channery loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is reddish brown loam about 3 inches thick. The upper part of the subsoil is reddish brown clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is reddish brown and light reddish brown loam. In some areas the surface layer is silt loam.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazard of water erosion and the low annual precipitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

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

152—Harlan-Kirtley association, 3 to 9 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Harlan silt loam, 3 to 9 percent slopes, on the lower part of hillslopes and 30 percent Kirtley loam, 6 to 9 percent slopes, on hillcrests and the upper part of hillslopes.

Included in this unit are areas of Baux channery loam; reddish, loamy soils; and porcellanite rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Harlan soil is very deep and well drained. It formed in alluvium derived from interbedded porcellanite and shale. Typically, the surface layer is reddish brown silt loam about 4 inches thick. The subsoil is reddish brown clay loam about 12 inches thick. The lower part to a depth of 60 inches or more is red loam. In some areas the surface layer is loam.

Permeability is moderate in the Harlan soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the

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

The Kirtley soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is reddish brown and dark reddish brown loam about 7 inches thick. The upper 7 inches of the subsoil is reddish brown clay loam. The lower part is yellowish red clay loam about 17 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is silt loam.

Permeability is moderate in the Kirtley soil.

Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Kirtley soil and the hazard of water erosion on both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and needleandthread. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

The Harlan soil is in capability subclass IIIe, nonirrigated, and the Kirtley soil is in capability subclass IVe, nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

153—Harlan-Kirtley association, 9 to 15 percent slopes. This map unit is on hillslopes. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Harlan loam on the lower part of hillslopes and 35 percent Kirtley loam on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Baux channery loam; reddish, loamy soils that are calcareous throughout; and porcellanite outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Harlan soil is very deep and well drained. It formed in alluvium derived from interbedded porcellanite and shale. Typically, the surface layer is reddish brown loam about 2 inches thick. The upper 11 inches of the subsoil is reddish brown clay loam. The next 11 inches is brown clay loam. The lower part to a depth of 60 inches or more is light brown loam. In some areas the surface layer is silt loam.

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

The Kirtley soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is reddish brown loam about 9 inches thick. The upper part of the subsoil is reddish brown clay loam about 7 inches thick. The lower part is strong brown loam about 16 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is silt loam.

Permeability is moderate in the Kirtley soil. Available water capacity also is moderate. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Kirtley soil and the hazard of water erosion on both soils. Maintaining crop

residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and needleandthread. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

154—Haverdad very fine sandy loam, 0 to 3 percent slopes. This very deep, well drained soil is on flood plains and low terraces. It formed in alluvium derived from sedimentary rock. Areas are elongated and are 10 to 50 acres in size. The native vegetation is mainly grasses, shrubs, and cottonwoods. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Draknab loamy sand, Clarkelen loam, and gravel bars. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown loam stratified with lenses of silt loam, sandy loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 rare flooding.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazard of wind erosion and the low annual precipitation. If used for irrigated crops, this unit has few limitations. Irrigation water needs to be applied carefully, however, to prevent the buildup of a high water table. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly green needlegrass, slender wheatgrass, western wheatgrass, needleandthread, and cottonwood. 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. As the ecological condition deteriorates, woody plants, such as snowberry, silver sagebrush, rabbitbrush, and wild rose, increase. As the ecological condition further deteriorates, annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Lowland, 10- to 14-inch precipitation zone, Northern Plains range site.

155—Haverdad loam, moist, 0 to 3 percent slopes. This very deep, well drained soil is on flood plains and low terraces. It formed in alluvium derived from sedimentary rock. Areas are elongated and are 10 to 50 acres in size. The native vegetation is mainly grasses, shrubs, and cottonwoods. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Draknab loamy sand, Clarkelen loam, and Havertel silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray loam about 8 inches thick. The underlying material to a depth of 60 inches or more is stratified loam, clay loam, fine sandy loam, and silty clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 rare flooding.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

This unit is well suited to irrigated and nonirrigated crops. Irrigation water needs to be applied carefully, however, to prevent the buildup of a high water table. Maintaining crop residue on or near the surface helps to control runoff and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community is mainly basin wildrye, western wheatgrass, green needlegrass, needleandthread, slender wheatgrass, and cottonwood. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 2,500 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, wild plum, and chokecherry increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site.

156—Haverdad silt loam, saline, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on low terraces and flood plains. It formed in alluvium derived from sedimentary rock. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Ulm clay loam, Haverdad very fine sandy loam, Draknab loamy sand, and Arvada fine sandy loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is pale brown silt loam about 1 inch thick. The underlying material to a depth of 60 inches or more is pale brown, stratified silty clay loam, loam, or fine sandy loam and is moderately saline. This soil is outside the range of the Haverdad series because it has a water table. This difference, however, does not significantly affect the use and management of this soil for livestock grazing and wildlife habitat.

Permeability is moderate in the Haverdad soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more for salt- and water-tolerant plants. Runoff is slow, and the hazard of water erosion is moderate. The hazard of wind erosion is slight. A fluctuating water table is at a depth of 1.5 to 3.0 feet from May through August. This soil is subject to occasional flooding for brief periods from March through June.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly alkali sacaton, bottlebrush squirreltail, inland saltgrass, and western wheatgrass. 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. As the ecological condition deteriorates, greasewood and inland saltgrass increase. As the ecological condition further deteriorates, annuals and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by the salinity. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is poor. The main limitations affecting seeding are the salinity and the wetness. The salinity of the soil should be considered when plants for rangeland seeding are selected. The wetness limits the use of mechanical equipment on this soil during early summer.

This map unit is in capability subclass VIs, nonirrigated, and is in the Saline Lowland, 10- to 14-inch precipitation zone, Northern Plains range site.

157—Haverdad loam, moist, saline, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on low terraces and flood plains. It formed in alluvium derived from sedimentary rock. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Haverdad very fine sandy loam, Kishona loam, and Absted fine sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 2 inches thick. The underlying material to a depth of 60 inches or more is pale brown, stratified silty clay loam, clay loam, loam, and fine sandy loam and is moderately saline. This soil is outside the range of the Haverdad series because it has a water table. This difference, however, does not significantly affect the use and management of this soil for livestock grazing and wildlife habitat.

Permeability is moderate in the Haverdad soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more for salt- and water-tolerant plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating water table is at a depth of 1.5 to 3.0 feet from May through August. This soil is subject to occasional flooding for brief periods from March through June.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly alkali sacaton, inland saltgrass, bottlebrush squirreltail, and western wheatgrass. The potential plant community produces about 2,300 pounds of air-dry vegetation per acre in normal years. Production varies from 3,100 pounds in favorable years to 1,600 pounds in unfavorable years. As the ecological condition deteriorates, greasewood and inland saltgrass increase. As the ecological condition further deteriorates, annuals and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by the salinity. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is poor. The main limitations affecting seeding are the salinity and the wetness. The salinity of the soil should be considered when plants for rangeland seeding are selected. The wetness limits the use of mechanical equipment on this soil during early summer.

This map unit is in capability subclass VIs, nonirrigated, and is in the Saline Lowland, 10- to 14-inch precipitation zone, Northern Plains range site.

158—Haverdad-Draknab complex, 0 to 3 percent slopes. This map unit is on low terraces and flood plains. Areas are elongated and are 100 to 300 acres in size. The native vegetation is mainly grasses, shrubs, and cottonwoods. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Haverdad very fine sandy loam and 40 percent Draknab 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 Clarkelen fine sandy loam, gravel bars, and sandbars. Included areas make up about 15 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 sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, stratified loam, sandy loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

The Draknab soil is very deep and excessively drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown, stratified sandy loam, loamy sand, and sand.

Permeability is rapid in the Draknab soil. Available water capacity is low. The 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 frequent flooding for brief periods from March through June.

This unit is used mainly for livestock grazing, nonirrigated hayland, and wildlife habitat. In a few areas it is used as irrigated hayland and pasture.

If this unit is used as hayland, the main management concern is the seasonal flooding. Droughtiness in the Draknab soil is also a limitation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly green needlegrass, slender wheatgrass, western wheatgrass, needleandthread, and a few cottonwood trees. 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. As the ecological condition deteriorates, silver sagebrush, rabbitbrush, and snowberry increase. As the ecological condition further deteriorates, annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass Vw, irrigated and nonirrigated, and is in the Lowland, 10- to 14-inch precipitation zone, Northern Plains range site.

159—Haverdad-Draknab complex, moist, 0 to 3 percent slopes. This map unit is on low terraces and flood plains. Areas are elongated and are 100 to 300 acres in size. The native vegetation is mainly grasses, shrubs, and cottonwoods. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Haverdad very fine sandy loam and 35 percent Draknab 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 Clarkelen loam, Havertel silt loam, gravel bars, and sandbars. Included areas make up about 25 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 sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, stratified loam, sandy loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

The Draknab soil is very deep and excessively drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is brown loamy fine sand about 2 inches thick. The underlying material to

a depth of 60 inches or more is pale brown, stratified sand and loamy sand.

Permeability is rapid in the Draknab soil. Available water capacity is low. The 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 frequent flooding for brief periods from March through June.

This unit is used mainly for nonirrigated hayland, livestock grazing, and wildlife habitat. In a few areas it is used as irrigated hayland.

If this unit is used as hayland, the main management concern is the seasonal flooding. Droughtiness in the Draknab soil is also a limitation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, slender wheatgrass, needleandthread, basin wildrye, Columbia needlegrass, Canada wildrye, slender wheatgrass, and a few cottonwood trees. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, wild plum, and chokecherry increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass Vw, irrigated and nonirrigated, and is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site.

160—Haverdad-Worthenton complex, 0 to 3 percent slopes. This map unit is on flood plains. Areas are elongated and are 50 to 200 acres in size. The native vegetation is mainly grasses, shrubs, cottonwoods, and willows. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Haverdad silt loam and 30 percent Worthenton 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 Draknab loamy sand and Kishona loam and areas of water. 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 sedimentary rock. Typically, the surface layer is brown silt loam about 4 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, stratified loam, sandy loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

The Worthenton soil is very deep and poorly drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is gray clay loam about 7 inches thick. The upper 13 inches of the subsoil is gray clay. The next 14 inches is greenish gray silty clay loam. The lower part to a depth of 60 inches or more is light greenish gray clay loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 6 to 18 inches for most plants but 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 fluctuating water table is at a depth of 0.5 foot to 1.5 feet from March through July and at a depth of 1.5 to 3.0 feet the rest of the year. This soil is subject to frequent flooding for brief periods from March through June.

This unit is used for livestock grazing, hay, and wildlife habitat.

If this unit is used for hay and pasture, the main management concerns are the seasonal flooding of both soils and the high water table in areas of the

Worthenton soil. The production of vegetation suitable for hay and pasture on the Worthenton soil is limited by the high water table. Irrigation water needs to be applied carefully. Applying irrigation water to areas of the Worthenton soil only during dry periods helps to prevent a rise in the level of the water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on the Haverdad soil is mainly green needlegrass, slender wheatgrass, western wheatgrass, needleandthread, and a few cottonwood trees. The potential plant community produces about 2,300 pounds of air-dry vegetation per acre in normal years. Production varies from 2,500 pounds in favorable years to 1,600 pounds in unfavorable years. As the ecological condition deteriorates, snowberry, silver sagebrush, rubber rabbitbrush, and wild rose increase. As the ecological condition further deteriorates, annuals invade.

The potential plant community on the Worthenton soil is mainly northern reedgrass, bluejoint reedgrass, Nebraska sedge, and tufted hairgrass. The potential plant community produces about 5,600 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. As the ecological condition deteriorates, spike sedge, inland sedge, and Baltic rush invade. As the ecological condition further deteriorates, annuals and cocklebur invade.

The Haverdad soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worthenton soil is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good on the Haverdad soil and poor on the Worthenton soil. The main limitation affecting seeding on the Worthenton soil is the wetness. The wetness limits the use of mechanical equipment on the Worthenton soil during spring and early in summer.

The Haverdad soil is in capability subclass Vw, irrigated and nonirrigated. The Worthenton soil is in capability subclass VIw, irrigated and nonirrigated. The Haverdad soil is in the Lowland, 10- to 14-inch precipitation zone, Northern Plains range site, and the Worthenton soil is in the Wetland, 10- to 14-inch precipitation zone, Northern Plains range site.

161—Haverdad, moist-Worthenton complex, 0 to 3 percent slopes. This map unit is on flood plains. Areas are elongated and are 50 to 200 acres in size. The native vegetation is mainly grasses, shrubs, cottonwoods, and willows. The canopy cover is 0 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 60 percent Haverdad very fine sandy loam and 30 percent Worthenton 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 Draknab loamy sand, Kishona loam, Clarkelen fine sandy loam, Coaliams loam, and Havertel silt loam. Included areas make up about 10 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 sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, stratified loam, sandy loam, and clay loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

The Worthenton soil is very deep and poorly drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is gray clay loam about 7 inches thick. The upper part of the subsoil is gray clay 17 inches thick. The next 10 inches is greenish gray silty clay loam. The lower part to a depth of 60 inches or more is light greenish gray clay loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 6 to 18 inches for most plants but 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 fluctuating water table is at a depth of 0.5 foot to 1.5 feet from March through July and at a depth of 1.5 to 3.0 feet the rest of the year. This soil is subject to frequent flooding for brief periods from March through June.

This unit is used for hay, livestock grazing, and wildlife habitat.

If this unit is used for hay and pasture, the main management concerns are the seasonal flooding of both soils and the high water table in areas of the Worthenton soil. The production of vegetation suitable for pasture is limited by the high water table of the Worthenton soil. Irrigation water needs to be applied carefully. Applying irrigation water to areas of the Worthenton soil only during dry periods helps to prevent a rise in the level of the water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on the Haverdad soil is mainly green needlegrass, western wheatgrass, slender wheatgrass, needleandthread, basin wildrye, Columbia needlegrass, Canada wildrye, and a few cottonwood trees. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, and woody plants, such as wild plum and chokecherry, increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

The potential plant community on the Worthenton soil is mainly northern reedgrass, bluejoint reedgrass, Nebraska sedge, and tufted hairgrass. The potential plant community produces about 6,000 pounds of air-dry vegetation per acre in normal years. Production varies from 7,000 pounds in favorable years to 4,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge, inland sedge, and Baltic rush increase. As the ecological condition further deteriorates, annuals and cocklebur invade.

The Haverdad soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worthenton soil is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good on the Haverdad soil and poor on the Worthenton soil. The main limitation affecting seeding on the Worthenton soil is the wetness. The wetness limits the use of mechanical equipment on the Worthenton soil during spring and early in summer.

The Haverdad soil is in capability subclass Vw, irrigated and nonirrigated. The Worthenton soil is in capability subclass VIw, irrigated and nonirrigated. The Haverdad soil is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worthenton soil is in the Wetland, 15- to 19-inch precipitation zone, Northern Plains range site.

162—Havertel silt loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on flood plains and low terraces. It formed in alluvium derived from sedimentary rock. Areas are elongated and are 10 to 80 acres in size. The native vegetation is mainly grasses, shrubs, and deciduous trees. The canopy cover is 0 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Haverdad loam, Nesda Variant gravelly sandy loam, Worthenton clay loam, and small gravel bars. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is brown silt loam 8 inches thick. The upper 12 inches of the substratum is grayish brown gravelly loamy sand. The lower part to a depth of 60 inches or more is pale brown very gravelly sand. Depth to the gravelly layer ranges from 14 to 34 inches.

Permeability in the Havertel soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 36 to 60 inches for most plants but 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. This soil is subject to occasional flooding for brief periods from May through August. A fluctuating water table is at a depth of 3 to 5 feet. Because most areas of this soil are irrigated or are near irrigated areas, the water table is at its highest level during the irrigation season.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is droughtiness. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent a rise in the level of the high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Wind erosion can be controlled by keeping the soil rough and cloddy

when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, basin wildrye, Columbia needlegrass, Canada wildrye, slender wheatgrass, and a few cottonwood trees. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, wild plum, and chokecherry increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good.

This map unit is in capability subclass IIIw, irrigated and nonirrigated, and is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site.

163—Hesperus Variant-Reget association, 10 to 65 percent slopes. This map unit is on mountain outwash terraces and hillslopes and in narrow, elongated drainageways. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly aspen trees. The canopy cover is 75 to 100 percent. Elevation is 4,000 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Hesperus Variant silt loam, 10 to 25 percent slopes, in drainageways and 35 percent Reget loam, 12 to 65 percent slopes, on hillslopes and terraces.

Included in this unit are small areas of Reget Variant loam and areas of soils that have granitic stones and boulders on the surface. Also included in this unit are numerous springs, seeps, and poorly drained soils that occur on the bottoms of drainageways. Numerous intermittent streams are also present. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Hesperus Variant soil is very deep and somewhat poorly drained. These soils formed in alluvium derived from sedimentary rock. Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The upper 15 inches of the subsoil is dark grayish brown and dark brown silty clay loam and dark yellowish brown clay loam. The lower 31 inches is yellowish brown clay loam and sandy clay loam. The upper 8 inches of the substratum is light yellowish brown sandy loam. The lower part to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand.

Permeability is moderately slow in the Hesperus Variant soil. Available water capacity is high. The effective rooting depth is 18 to 60 inches for most plants but is 60 inches or more for plants that can tolerate a water table. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is moderate. Depth to a seasonal high water table is 1.5 to 5.0 feet from May through September.

The Reget soil is moderately deep and well drained. It formed in alluvium and residuum derived from sedimentary rock. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The upper 25 inches of the subsoil is yellowish brown clay. The lower part is light yellowish brown clay loam about 7 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used for livestock grazing and wildlife habitat.

The principal vegetation on this unit is mainly quaking aspen with an understory of mountain brome, slender wheatgrass, Columbia needlegrass, hawthorn, and blue wildrye. The production of air-dry vegetation is about 3,500 pounds per acre in normal years. The production varies from 4,000 pounds in favorable years to 3,000 pounds in unfavorable years. This unit has few limitations affecting plants that are suitable for livestock grazing.

This map unit is in capability subclass VIe, nonirrigated, and is an aspen woodland site.

164—Hiland-Bowbac association, 3 to 15 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Hiland fine sandy loam, 3 to 15 percent slopes, on foot slopes and alluvial fans and 30 percent Bowbac sandy loam, 6 to 15

percent slopes, on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Decolney fine sandy loam and Tullock fine sandy 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 alluvium derived from sandstone. Typically, the surface layer is light brownish gray fine sandy loam about 4 inches thick. The upper 13 inches of the subsoil is brown sandy clay loam. The next 13 inches is light yellowish brown sandy clay loam. The lower part to a depth of 60 inches or more is pale brown sandy loam. In some areas the surface layer is loam.

Permeability is moderate in the Hiland soil. Available water capacity is high. The 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 residuum and alluvium derived from sandstone. Typically, the surface layer is yellowish brown sandy loam about 4 inches thick. The upper part of the subsoil is brown sandy clay loam about 11 inches thick. The lower part is light yellowish brown sandy loam about 9 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is moderate in the Bowbac soil. Available water capacity is low. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Bowbac soil and the hazards of wind and water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. 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. As the ecological condition deteriorates, fringed sagewort, blue grama, yucca, and cudweed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. 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. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated, and is in the Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

165—Hiland-Bowbac association, moist, 3 to 15 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 15 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Hiland fine sandy loam, 3 to 9 percent slopes, on foot slopes and alluvial fans, and 30 percent Bowbac sandy loam, 6 to 15 percent slopes, on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Moskee sandy loam, Hargreave sandy loam, Cedak loam, and Recluse loam. Included areas make up about 20 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 derived from sandstone. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The upper 13 inches of the subsoil is yellowish brown sandy clay loam. The next 7 inches is light yellowish brown sandy clay loam. The lower part to a depth of 60 inches or more is very pale brown sandy loam.

Permeability is moderate in the Hiland soil. Available water capacity is high. The 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 residuum and alluvium derived from sandstone. Typically, the surface layer is dark yellowish brown sandy loam about 7 inches thick. The upper part of the subsoil is yellowish brown sandy clay loam about 23 inches thick. The lower part is light olive brown sandy loam about 9 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Bowbac soil. Available water capacity also is moderate. The 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 mainly used for livestock grazing and wildlife habitat. In a few areas it is used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed for seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Hiland soil is in capability subclass IIIe, nonirrigated, and the Bowbac soil is in capability subclass IVe, nonirrigated. This map unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

166—Hiland-Decolney complex, 3 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Hiland sandy loam and 35 percent Decolney 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 Tullock fine sandy loam, Bowbac fine sandy loam, and Vonalee loamy sand. Also included in this unit on terrace breaks near major drainageways are soils that are similar to the Hiland soil but have a gravelly lower part of the subsoil. Included areas make up about 15 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 eolian deposits and alluvium derived from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick. The upper part of the subsoil is pale brown sandy clay loam about 13 inches thick. The next 12 inches is light brownish gray sandy clay loam. The lower part to a depth of 60 inches or more is sandy loam.

Permeability is moderate in the Hiland soil. Available water capacity is high. The 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 Decolney soil is very deep and well drained. It formed in eolian deposits and alluvium derived from sandstone. Typically, the surface layer is dark brown loamy sand about 2 inches thick. The subsoil is dark brown sandy clay loam about 9 inches thick. The substratum to a depth of 60 inches or more is yellowish brown sandy loam.

Permeability is moderate in the Decolney soil. Available water capacity is high. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion and the low annual precipitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, and Indian ricegrass. 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. As the ecological condition deteriorates, fringed sagewort, blue grama, yucca, and cudweed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, nonirrigated, and is in the Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

167—Hiland-Vonalee complex, moist, 3 to 10 percent slopes. This map unit is on alluvial fans and hills. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Hiland sandy loam and 35 percent Vonalee 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 Tullock fine sandy loam and Decolney loamy sand. Included areas make up about 20 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 eolian deposits and alluvium derived from sandstone. Typically, the surface layer is yellowish brown sandy loam about 4 inches thick. The upper 12 inches of the subsoil is yellowish brown sandy clay loam. The next 7 inches is brownish yellow sandy clay loam. The lower part to a depth of 60 inches or more is very pale brown fine sandy loam.

Permeability is moderate in the Hiland soil. Available water capacity is high. The 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 Vonalee soil is very deep and somewhat excessively drained. It formed in alluvium and eolian deposits derived from sandstone. Typically, the surface layer is yellowish brown loamy sand about 3 inches thick. The upper part of the subsoil is yellowish brown sandy loam about 16 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown and yellow loamy sand and loamy fine sand.

Permeability is moderately rapid in the Vonalee soil. Available water capacity is moderate. The 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 mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion and the low annual precipitation. The droughtiness of the Vonalee soil is also a limitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies

from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IIIe, nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

168—Hilight-Rock outcrop complex, 10 to 30 percent slopes. This map unit is on ridges and hillslopes. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Hilight clay loam, 10 to 30 percent slopes, on ridges and hillslopes and 30 percent areas of 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 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 Hilight soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 1 inch thick. The upper 3 inches of the underlying material is light gray silty clay. The lower part is light brownish gray silty clay about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Hilight soil. Available water capacity is very low. The 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 areas of Rock outcrop dominantly consist of exposures of interbedded, varicolored, fine textured shale. Exposures of sandstone and lignite are also present.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Hilight soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. 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. As the ecological condition deteriorates, big sagebrush and birdfoot sagebrush increase. As the ecological condition further deteriorates, broom snakeweed and annuals invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the shallow rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the shallow soil depth, the areas of Rock outcrop, and the slope.

The Hilight soil is in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Hilight soil is in the Shallow Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

169—Jonpol-Platmak association, 0 to 9 percent slopes. This map unit is on terraces, hillslopes, alluvial fans, and mesa tops. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Jonpol loam on the periphery of the mesa tops and terraces and on the upper part of hillslopes and 40 percent Platmak loam on alluvial fans, in the central areas of mesa tops and terraces, and on the lower part of hillslopes.

Included in this unit are small areas of Recluse very fine sandy loam, Cedak loam, Nuncho loam, and in areas of porcellanite, Harlan loam and Kirtley loam. Also included are areas of shallow, loamy soils that

are intermingled with the Jonpol soil on some mesa tops east of Wyarno. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Jonpol soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is dark grayish brown loam about 3 inches thick. The upper 12 inches of the subsoil is dark brown clay. The next 4 inches is yellowish brown clay loam. The lower part is pale brown loam about 13 inches thick over weakly consolidated shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Jonpol soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Platmak soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown loam about 4 inches thick. The upper 12 inches of the subsoil is dark grayish brown clay. The next 4 inches is grayish brown clay loam. The lower part to a depth of 60 inches or more is light brownish gray clay loam.

Permeability is slow in the Platmak soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. The slow permeability and the slope are also limitations if this unit is used as irrigated cropland. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment.

The Jonpol soil is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and the Platmak soil is in capability subclass IIIe, irrigated and nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

170—Jonpol-Platmak association, 9 to 25 percent slopes. This map unit is on terraces, alluvial fans, and hillslopes. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Jonpol loam on the upper part of hillslopes and 35 percent Platmak loam on terraces, alluvial fans, and the lower part of hillslopes.

Included in this unit are small areas of Recluse very fine sandy loam, Cedak loam, and Nuncho loam. Also included in the areas near Prairie Dog Creek is a soil that is similar to the Platmak soil but has a dark brown surface layer and upper part of the subsoil extending to a depth of 20 to 25 inches. Also included are areas of Harlan loam and Kirtley loam near areas of porcellanite. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Jonpol soil is moderately deep and well drained. It formed in colluvium and residuum derived from interbedded shale and sandstone. Typically, the surface layer is brown loam about 3 inches thick. The upper 12 inches of the subsoil is brown clay. The next

4 inches is pale brown clay loam. The lower part is very pale brown loam about 4 inches thick over weakly consolidated sandstone. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Jonpol soil. Available water capacity is low. The 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 slight.

The Platmak soil is very deep and well drained. It formed in alluvium derived from interbedded shale and sandstone. Typically, the surface layer is brown loam about 6 inches thick. The upper 8 inches of the subsoil is brown clay. The next 12 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is very pale brown clay loam.

Permeability is slow in the Platmak soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

171—Kishona-Cambria complex, 0 to 3 percent slopes. This map unit is on alluvial fans and terraces. Areas are deltaic in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Kishona loam and 30 percent Cambria 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 Zigweid loam, Forkwood loam, Wyarno clay loam, and on flood plains, Haverdad fine sandy loam. Also included in cultivated areas are soils that are similar to the Kishona and Cambria soils but have a dark surface layer about 5 to 8 inches thick. Included areas make up about 20 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 interbedded sedimentary rocks. Typically, the surface layer is light yellowish brown loam about 8 inches thick. The subsoil to a depth of 60 inches or more is very pale brown loam. In some areas the surface layer is very fine sandy loam or clay loam. In other areas the substratum below a depth of 40 inches is strongly alkaline.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 interbedded sedimentary rocks. Typically, the surface layer is pale brown very fine sandy loam about 5 inches thick. The upper part of the subsoil is brown clay loam about 11 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If used for irrigated crops, this unit has few limitations. Maintaining crop residue on or near the surface helps to control runoff and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

172—Kishona-Cambria complex, 3 to 6 percent slopes. This map unit is on alluvial fans and terraces. Areas are deltaic in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Kishona loam and 35 percent Cambria 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 Forkwood loam, Zigweid loam, and Wyarno clay loam. Also included in cultivated areas are soils that are similar to the Kishona and Cambria soils but have a dark surface layer 6 to 10 inches thick. Included areas make up about 20 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 interbedded sedimentary rocks. Typically, the surface layer is pale brown loam about 2 inches thick. The subsoil to a depth of 60 inches or more is very pale brown loam. In some areas the surface layer is very fine sandy loam or clay loam. In other areas the substratum below a depth of 40 inches is strongly alkaline.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 interbedded sedimentary rocks. Typically, the surface layer is pale brown very fine sandy loam about 3 inches thick. The upper part of the subsoil is pale brown clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If used as irrigated cropland, this unit has few limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation

water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of wind erosion. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

173—Lambman-Hargreave association, 3 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Lambman sandy loam, 3 to 15 percent slopes, on hillcrests and the upper part of hillslopes and 40 percent Hargreave fine sandy loam, 3 to 10 percent slopes, on the lower part of hillslopes.

Included in this unit are small areas of Taluce sandy loam, Bowbac sandy loam, Moskee sandy loam, and shallow sandy clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lambman soil is shallow and well drained. It formed in residuum and alluvium derived from sandstone. Typically, the surface layer is dark brown sandy loam about 1 inch thick. The upper part of the subsoil is brown sandy clay loam about 7 inches thick. The lower part is very pale brown sandy clay loam about 7 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Lambman soil. Available water capacity is very low. The 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.

The Hargreave soil is moderately deep and well drained. It formed in residuum and alluvium derived from sandstone. Typically, the surface layer is dark brown fine sandy loam about 2 inches thick. The upper 13 inches of the subsoil is dark brown sandy clay loam. The next 8 inches is yellowish brown sandy clay loam. The lower part is pale brown sandy clay loam about 9 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Hargreave soil. Available water capacity also is moderate. The 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.

Most areas of this unit are used for livestock grazing and wildlife habitat. In a few areas the Hargreave soil is used for nonirrigated crops.

The Lambman soil is not suited to cropland because of droughtiness and the shallow rooting depth. If the Hargreave soil is used as cropland, the main management concerns are the hazards of wind and water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on the Lambman soil is mainly prairie sandreed, needleandthread, western wheatgrass, sand bluestem, silver sagebrush, and bluebunch wheatgrass. 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 900 pounds

in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, yucca, and forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and annuals invade.

The potential plant community on the Hargreave soil is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years, 3,000 pounds in favorable years, and 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

The production of vegetation suitable for livestock grazing on the Lambman soil is limited by droughtiness. The Hargreave soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for range seeding is poor on the Lambman soil and fair on the Hargreave soil. The main limitations affecting seeding on the Lambman soil are the shallow depth to bedrock and the hazards of wind and water erosion. The main management concerns affecting seeding on the Hargreave soil are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Lambman soil is in capability subclass VIe, nonirrigated, and the Hargreave soil is in capability subclass IVe, nonirrigated. The Lambman soil is in the Shallow Sandy, 15- to 19-inch precipitation zone, Northern Plains range site. The Hargreave soil is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

174—Lucky-Burgess-Hazton association, 8 to 30 percent slopes. This map unit is on mountain slopes. Areas are irregular in shape and are 100 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 20 to 25 inches, the average annual temperature is 41 to 43 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 35 percent Lucky gravelly loam, 8 to 25 percent slopes, on dip slopes; 30 percent Burgess gravelly sandy loam, 8 to 20 percent slopes, on the lower part of mountain slopes between ridges; and 20 percent Hazton gravelly sandy loam, 10 to 30 percent slopes, on the upper part of mountain slopes and ridges.

Included in this unit are small areas of Granile gravelly sandy loam, granitic rock outcrop, wet soils, and soils that are similar to the Hazton soil but containing more gravel. Included areas make up about 15 percent of the total acreage. Percentages vary from one area to another.

The Lucky soil is moderately deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface layer is dark brown gravelly loam about 5 inches thick. The upper 6 inches of the subsoil is dark yellowish brown gravelly sandy clay loam. The next 6 inches is yellowish brown gravelly sandy clay loam. The substratum is light yellowish brown very gravelly sandy loam about 7 inches thick over fractured, hard granite. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Lucky soil. Available water capacity is very low. The 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 Burgess soil is moderately deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface layer is dark brown gravelly sandy loam about 4 inches thick. The upper 5 inches of the subsoil is dark yellowish brown gravelly sandy loam. The next 4 inches is brown gravelly sandy loam. The substratum is yellowish brown gravelly sandy loam about 21 inches thick over fractured granite. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately rapid in the Burgess soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Hazton soil is shallow and well drained. It formed in residuum derived from granite. Typically, the surface layer is dark brown gravelly sandy loam about 8 inches thick. The underlying material is brown gravelly sandy loam about 6 inches thick over hard granite. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderately rapid in the Hazton soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is Columbia needlegrass, Idaho fescue, western wheatgrass, spike fescue, and bluebunch wheatgrass. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope, the gravelly surface layer, and the hazard of water erosion on all of the soils and the depth to bedrock in areas of the Hazton soil.

The Lucky and Burgess soils are in capability subclass VIe, nonirrigated, and the Hazton soil is in capability subclass VIIe, nonirrigated. This map unit is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site.

175—Moskee sandy loam, 0 to 3 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium and eolian deposits derived from sandstone. In the Banner and Big Horn areas this soil formed in material derived predominantly from arkosic sandstone. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho sandy clay loam and Recluse loam. Also included are small areas of a soil that is similar to the Moskee soil but is dark brown to a depth of 20 to 25 inches. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark brown sandy loam about 3 inches thick. The upper part of the subsoil is brown sandy clay loam about 17 inches thick. The lower part to a depth of 60 inches or more is pale brown sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of wind erosion. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern affecting seeding is hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is considered prime farmland in areas where it is irrigated. This unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

176—Moskee sandy loam, 3 to 6 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium and eolian deposits derived from sandstone. In the Banner and Big Horn areas this soil formed in material derived predominantly from arkosic sandstone. Areas are

irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho sandy clay loam and Recluse loam. Also included are small areas of a soil that is similar to the Moskee soil but is dark brown to a depth of 20 to 25 inches. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown sandy loam about 4 inches thick. The upper 6 inches of the subsoil is grayish brown sandy clay loam. The next 19 inches is yellowish brown sandy clay loam. The lower part to a depth of 60 inches or more is yellowish brown sandy loam. In some areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of wind erosion. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concern affecting seeding is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is considered prime farmland in areas where it is irrigated. This unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

177—Moskee fine sandy loam, 6 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and hillslopes. It formed in alluvium and eolian deposits derived from sandstone. In the Banner and Big Horn areas this soil formed in materials derived predominantly from arkosic sandstone. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Hargreave fine sandy loam and Recluse loam. Also included are small areas of a soil that is similar to the Moskee soil but is dark brown to a depth of 20 to 25 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The upper 16 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 16 inches is light brownish gray fine sandy loam. The substratum to a depth of 60 inches or more is brown sandy loam. In some areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazards of wind and water erosion. The slope is also a limitation if this unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

178—Moskee-Noden complex, 0 to 9 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is about 110 to 120 days.

This unit is 50 percent Moskee 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 Nuncho loam, Recluse fine sandy loam, and Hargreave 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 derived from sandstone. Typically, the surface layer is dark brown sandy loam about 4 inches thick. The upper part of the subsoil is brown sandy clay loam about 25 inches thick. The next 16 inches is light gray sandy clay loam. The substratum to a depth of 60 inches or more is light gray sandy loam. In cultivated areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 Noden soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam about 2 inches thick. The upper 11 inches of the subsoil is dark brown sandy clay loam. The lower 23 inches is dark yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light olive brown sandy loam.

Permeability is moderate in the Noden soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazards of wind and water erosion. The slope is also a limitation if this unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years

when the snow melts rapidly while the soil is still frozen. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

179—Moskee-Noden fine sandy loams, 9 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Moskee 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 Recluse sandy loam and Hargreave 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 derived from sandstone. Typically, the surface layer is dark brown fine sandy loam about 1 inch thick. The upper part of the subsoil is dark brown sandy clay loam about 15 inches thick. The lower 17 inches is light gray fine sandy loam. The substratum to a depth of 60 inches or more is light gray fine sandy loam. In cultivated areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Noden soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark grayish brown fine sandy loam about 2 inches thick. The upper 10 inches of the subsoil is dark grayish brown sandy clay loam. The lower 18 inches is dark yellowish brown and yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown fine sandy loam.

Permeability is moderate in the Noden soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concerns are the hazards of wind and water erosion. The slope is also a limitation if this unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological

condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

180—Moskee-Noden fine sandy loams, dry, 0 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Moskee 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 Hiland sandy loam and Bowbac 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 derived from sandstone. Typically, the surface layer is brown fine sandy loam about 5 inches thick. The upper part of the subsoil is dark brown sandy clay loam about 10 inches thick. The lower 15 inches is light gray fine sandy loam. The substratum to a depth of 60 inches or more is light gray fine sandy loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 Noden soil is very deep and well drained. It formed in alluvium derived from sandstone. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is dark yellowish brown sandy clay loam about 15 inches thick. The substratum to a depth of 60 inches or more is pale brown sandy loam.

Permeability is moderate in the Noden soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion and the low annual precipitation. If this unit is used for irrigated crops, the main management concerns are the hazards of wind and water erosion and the slope. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly needleandthread, prairie sandreed, little bluestem, and Indian ricegrass. 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. As the ecological condition deteriorates, fringed sagewort, blue grama, yucca, and cudweed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concerns affecting seeding are the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is

needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

181—Moskee-Nuncho complex, 0 to 3 percent slopes. This map unit is on alluvial fans. Areas are irregular in shape and are 100 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,100 to 4,500 feet. The average annual precipitation is about 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Moskee sandy loam and 40 percent Nuncho sandy 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 Recluse loam and Nuncho clay 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 materials derived from arkosic sandstone. Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The upper part of the subsoil is brown sandy clay loam about 13 inches thick. The lower 10 inches is pale brown sandy clay loam. The substratum to a depth of 60 inches or more is light gray sandy clay loam. In some areas the surface layer is sandy clay loam and the substratum is sandy loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 Nuncho soil is very deep and well drained. It formed in alluvium derived from sandstone and shale. Typically, the surface layer is grayish brown sandy clay loam about 8 inches thick. The upper 16 inches of the subsoil is grayish brown sandy clay. The next 16 inches is light brownish gray sandy clay loam. The substratum to a depth of 60 inches or more is pale brown loamy sand. In some areas the surface layer is sandy loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of wind erosion. If this unit is used for irrigated crops, the slow permeability in the Nuncho soil is also a limitation. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern affecting seeding is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is considered prime farmland in areas where it is irrigated. This unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

182—Moskee-Nuncho complex, 3 to 6 percent slopes. This map unit is on alluvial fans and hillslopes. Areas are irregular in shape and are 100 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,100 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Moskee sandy loam and 40 percent Nuncho sandy 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 Recluse loam. Also included are soils that are similar to the Moskee soil but have a thicker surface layer. 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 materials derived from arkosic sandstone. Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The upper 5 inches of the subsoil is very dark grayish brown sandy clay loam. The next 22 inches is brown sandy clay loam. The substratum to a depth of 60 inches or more is grayish brown sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The 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 Nuncho soil is very deep and well drained. It formed in alluvium derived from sandstone and shale. Typically, the surface layer is dark grayish brown sandy clay loam about 10 inches thick. The upper 17 inches of the subsoil is brown sandy clay. The lower 13 inches is yellowish brown sandy clay loam. The substratum to a depth of 60 inches or more is light gray loamy sand. In some areas the surface layer is sandy loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of wind erosion. If this unit is used for irrigated crops, the slow permeability in the Nuncho soil is also a limitation. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, little bluestem, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years, 3,000 pounds in favorable years, and 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern affecting seeding is the hazard of wind erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is considered prime farmland in areas where it is irrigated. This unit is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

183—Moskee-Worthenton, moist, association, 0 to 45 percent slopes. This map unit is in drainageways and on hillslopes and alluvial fans. Areas are elongated and sinuous in shape and are 50 to 100 acres in size. The native vegetation is mainly grasses, shrubs, and trees. The canopy cover is 20 to 80 percent. Aspen grow on the poorly drained soils on the bottoms of drainageways, and ponderosa pine grow on the well drained hillslopes and alluvial fans. Elevation is 4,100 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Moskee sandy loam, 3 to 45 percent slopes, on hillslopes and alluvial fans and 35 percent Worthenton clay loam, 0 to 3 percent slopes, on the bottoms of drainageways.

Included in this unit are small areas of Nuncho Variant clay loam, Coaliams loam, Hargreave sandy loam, and a soil that is similar to the Worthenton soil but is sandy clay loam in the lower part of the subsoil. 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 colluvium derived from sedimentary rock. Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is brown sandy clay loam about 14 inches thick. The lower part to a depth of 60 inches or more is light gray sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability is moderate in the Moskee soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Worthenton soil is very deep and poorly drained. It formed in alluvium derived from sedimentary rock. Typically, the surface is covered with a layer of organic matter 2 inches thick. The surface layer is dark grayish brown clay loam about 4 inches thick. The upper 13 inches of the subsoil is grayish brown clay. The lower part to a depth of 60 inches or more is olive gray silty clay loam. In some areas the surface layer is loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 6 to 18 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to occasional flooding for brief periods from March through June. A fluctuating water table is at a depth of 0.5 foot to 1.5 feet from March through July and at a depth of 1.5 to 3.0 feet the rest of the year.

This unit is used for livestock grazing and wildlife habitat.

The plant community on the Moskee soil is mainly ponderosa pine with an understory of common chokecherry, mountain brome, Columbia needlegrass, bluegrass, and slender wheatgrass.

The plant community on the Worthenton soil is mainly quaking aspen with an understory of mountain brome, slender wheatgrass, tufted hairgrass, and blue wildrye.

The production of vegetation suitable for livestock grazing on the Moskee soil is limited by the canopy cover. The Worthenton soil has few limitations affecting plants that are suitable for livestock grazing. The slope of the Moskee soil limits access by livestock and results in overgrazing in the less sloping areas.

The Moskee soil is in capability subclass VIe, nonirrigated, and the Worthenton soil is in capability subclass VIw, nonirrigated. This map unit is a woodland site.

184—Nathrop-Passcreek-Starley association, 3 to 40 percent slopes. This map unit is on mountain slopes, alluvial fans, dip slopes, and ridges. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,500 to 7,500 feet. The average annual precipitation is 19 to 25 inches, the average annual temperature is 41 to 43 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 30 percent Nathrop loam, 10 to 40 percent slopes, on mountain dip slopes; 30 percent Passcreek loam, 3 to 15 percent slopes, on alluvial fans and the lower part of mountain slopes; and 20 percent Starley loam, 10 to 40 percent slopes, on ridges and the upper part of mountain slopes.

Included in this unit are small areas of Starman channery loam, Echemoor silt loam, and limestone outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

This unit joins the Nathrop-Passcreek-Starley association, 2 to 30 percent slopes, map unit in the Big Horn National Forest. The unit in the Sheridan County Area includes slightly steeper slopes than that in the National Forest. The two units have no difference in use and management.

The Nathrop soil is moderately deep and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is grayish brown loam about 6 inches thick. The upper part of the subsoil is grayish brown very cobbly clay loam about 7 inches thick. The lower part is pale brown very cobbly clay loam about 26 inches thick over limestone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Nathrop soil. Available water capacity is low. The 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 Passcreek soil is moderately deep and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The upper part of the subsoil is dark yellowish brown clay loam about 7 inches thick. The next 6 inches is yellowish brown gravelly clay loam. The lower part is brown very gravelly clay loam about 14 inches thick over hard limestone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Passcreek soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Starley soil is shallow and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is brown loam about 9 inches thick. The subsoil is yellowish brown very cobbly loam about 8 inches thick over limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Starley soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Nathrop and Passcreek soils is mainly Idaho fescue, western wheatgrass, spike fescue, green needlegrass, and bluebunch wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Starley soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Nathrop and Passcreek soils have few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Starley soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Nathrop and Passcreek soils are in capability subclass VIe, nonirrigated, and the Starley soil is in capability subclass VIIe, nonirrigated. The Nathrop and Passcreek soils are in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Starley soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

185—Nesda stony silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on low terraces and flood plains. It formed in alluvium derived from limestone, granite, and sandstone. Areas are deltaic in shape and elongated and are 25 to 100 acres in size. The native vegetation is mainly grasses, forbs, and shrubs. The canopy cover is 5 to 15 percent. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Twin Creek Variant silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is very dark grayish brown stony silt loam about 10 inches thick. The upper 33 inches of the underlying material is pale brown very gravelly loamy sand. The lower part to a depth of 60 inches or more is yellowish red extremely gravelly sand.

Permeability is rapid in the Nesda soil. Available water capacity is very low. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 18 to 60 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. Depth to the seasonal high water table is 1.5 to 5.0 feet from May through September. This soil is subject to rare flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this soil is Nebraska sedge, slender wheatgrass, tufted hairgrass, and spike sedge. The potential plant community produces about 5,000 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 3,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, Canada thistle, foxtail barley, and timothy invade.

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

management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. Stones on the surface restrict the use of mechanical equipment for brush control or rangeland seeding.

This map unit is in capability subclass VIs, nonirrigated, and is in the Subirrigated, 15- to 19-inch precipitation zone, Northern Plains range site.

186—Nesda-Rubble land complex, 0 to 3 percent slopes. This map unit is on terraces. Areas are elongated and are 75 to 200 acres in size. The native vegetation is mainly ponderosa pine, shrubs, forbs, and grasses. The canopy cover on the Nesda soil is 75 to 100 percent. Elevation is 4,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Nesda stony silt loam and 40 percent areas of Rubble land. The percentage of the Nesda soil increases eastward from the base of the mountains. 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 Worthenton Variant loam, Assinniboine Variant sandy loam, and Farnuf Variant silt loam. Also included are small areas of a soil that is similar to the Nesda soil but has a water table at a depth of 1.5 to 4.0 feet from May through September. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Nesda soil is very deep and well drained. It formed in alluvium derived from limestone, granite, and sandstone. Typically, the surface layer is very dark grayish brown stony silt loam about 10 inches thick. The upper 30 inches of the underlying material is pale brown very gravelly loamy sand. The lower part to a depth of 60 inches or more is yellowish red very gravelly sand.

Permeability is rapid in the Nesda soil. Available water capacity is very low. The 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.

In areas of Rubble land 90 percent or more of the surface is covered with granitic stones and boulders ranging in size from 2 to 4 feet in diameter. The material to a depth of several feet contains 80 to 95 percent boulders.

This unit is used for wildlife habitat.

The plant community on the Nesda soil is mainly ponderosa pine with an understory of common chokecherry, Columbia needlegrass, bluegrass, and slender wheatgrass. The production of vegetation suitable for livestock grazing is limited by the canopy cover.

The Nesda soil is in capability subclass VIs, nonirrigated, and the areas of Rubble land are in capability class VIII. The Nesda soil is a woodland site.

187—Nesda Variant-Havertel complex, 0 to 3 percent slopes. This map unit is on low terraces and flood plains. Areas are elongated and are 10 to 400 acres in size. The native vegetation is mainly shrubs, grasses, and deciduous trees. The canopy cover is 5 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Nesda Variant gravelly sandy loam and 30 percent Havertel silt 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 Haverdad loam, Draknab loamy sand, and areas of soils that have many granitic stones and boulders on the surface. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Nesda Variant soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the upper 3 inches of the surface layer is dark brown gravelly sandy loam. The next 8 inches is brown very gravelly sandy loam. The upper 36 inches of the underlying material is light yellowish brown very gravelly loamy sand. The lower part to a depth of 60 inches or more is pale brown extremely gravelly sand.

Permeability is very rapid in the Nesda Variant soil. Available water capacity is very low. The 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 occasional flooding for brief periods from May through August.

The Havertel soil is very deep and moderately well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown silt loam about 16 inches thick. The underlying material to a depth of 60 inches or more is pale brown very gravelly sand.

Permeability in the Havertel soil is moderate in the surface layer and very rapid in the underlying material. Available water capacity is moderate. The effective

rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 36 to 60 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to occasional flooding for brief periods from May through August. A seasonal fluctuating water table is at a depth of 3 to 5 feet from March through October.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly green needlegrass, Columbia needlegrass, western wheatgrass, basin wildrye, Canada wildrye, slender wheatgrass, and a few cottonwood trees. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, wild plum, and chokecherry increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, timothy, and forbs invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability for rangeland seeding is fair on the Nesda Variant soil and good on the Havertel soil. The main limitation affecting seeding on the Nesda Variant soil is the gravel in the surface layer.

The Nesda Variant soil is in capability subclass VIs, nonirrigated, and the Havertel soil is in capability subclass IVs, nonirrigated. This unit is in the Lowland, 15- to 19-inch precipitation zone, Northern Plains range site.

188—Norbert-Doney-Rock outcrop complex, 8 to 45 percent slopes. This map unit is on hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,300 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Norbert clay, 25 percent Doney loam, and 20 percent areas of shale 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 Reget loam, Savage loam, Farnuf silt loam, Arnegard loam, and areas of somewhat poorly drained and poorly drained soils in narrow drainageways. Because of the presence of various uplifted geological formations, the included soils have many variations from area to area. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Norbert soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay about 2 inches thick. The underlying material is light brownish gray silty clay about 12 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is very slow in the Norbert soil. Available water capacity is very low. The 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 Doney soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown loam about 1 inch thick. The upper 14 inches of the subsoil is pale brown clay loam. The lower part is very pale brown clay loam about 12 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Doney soil. Available water capacity is low. The 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 areas of Rock outcrop consist of exposures of shale.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Norbert soil is mainly western wheatgrass, thickspike wheatgrass, little bluestem, bluebunch wheatgrass, spike fescue, and green needlegrass. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Doney soil is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing on the Norbert soil is limited by droughtiness and the rooting depth. The Doney soil has few limitations affecting plants that are suitable for livestock grazing; however, the slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Norbert and Doney soils are in capability subclass VIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Norbert soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site, and the Doney soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

189—Norbert-Eltsac complex, 15 to 35 percent slopes. This map unit is on dissected ridges and hillslopes. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Norbert clay and 35 percent Eltsac 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 shale outcrop. This inclusion makes up about 15 percent of the total acreage. The percentage varies from one area to another.

The Norbert soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay about 2 inches thick. The underlying material is grayish brown clay about 17 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is very slow in the Norbert soil. Available water capacity is very low. The 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 Eltsac soil is moderately deep and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray silty clay about 1 inch thick. The upper 15 inches of the subsoil is light gray clay. The lower part is light brownish gray clay about 23 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is very slow in the Eltsac soil. Available water capacity is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Norbert soil is mainly green needlegrass, western wheatgrass, little bluestem, bluebunch wheatgrass, thickspike wheatgrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Eltsac soil is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

The production of vegetation suitable for livestock grazing on the Norbert soil is limited by droughtiness. The Eltsac soil has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so

that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. Tillage is not recommended.

This map unit is in capability subclass VIe, nonirrigated. The Norbert soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site. The Eltsac soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

190—Norbert-Reget-Savar association, 3 to 35 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 30 percent Norbert clay, 10 to 35 percent slopes, on hillcrests and the upper part of hillslopes; 25 percent Reget silt loam, 6 to 20 percent slopes, on the upper part of hillslopes; and 25 percent Savar clay loam, 3 to 9 percent slopes, on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Farnuf loam, Savage loam, and Wayden silty clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Norbert soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay about 1 inch thick. The underlying material is grayish brown and light brownish gray clay about 18 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

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

The Reget soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is dark grayish brown silt loam about 11 inches thick. The upper part of the subsoil is brown clay about 15 inches thick. The lower part is light yellowish brown clay about 12 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The 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 Savar soil is very deep and well drained. It formed in alluvium and colluvium derived from shale. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The upper part of the subsoil is dark grayish brown clay about 18 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown clay.

Permeability is slow in the Savar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for livestock grazing and wildlife habitat. In some areas the Savar soil is used for irrigated and nonirrigated crops.

The Norbert soil is not suited to cropland because of the slope and the rooting depth. The Reget soil is not suited to cropland because of the slope. If the Savar soil is used for crops, the main management concern is the hazard of water erosion. If the Savar soil is used for irrigated crops, the slope and the slow permeability are also limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Maintaining crop residue on or near the surface helps to control runoff and erosion. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff.

The potential plant community on the Norbert soil is mainly western wheatgrass, thickspike wheatgrass, little bluestem, bluebunch wheatgrass, spike fescue, and green needlegrass. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Reget soil is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the

ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Savar soil is green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

The production of vegetation suitable for livestock grazing on the Norbert soil is limited by droughtiness. The Reget and Savar soils have few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Norbert and Reget soils are in capability subclass VIe, nonirrigated, and the Savar soil is in capability subclass IVe, irrigated and nonirrigated. The Norbert soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site; the Reget soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site; and the Savar soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

191—Norbert-Rock outcrop complex, 15 to 35 percent slopes. This map unit is on dissected hills. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Norbert clay, 15 to 35 percent slopes, and 35 percent areas of shale 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 Eltsac silty clay and Reget silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Norbert soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay about 1 inch thick. The underlying material is grayish brown and light brownish gray clay about 18 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is very slow in the Norbert soil. Available water capacity is very low. The 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 areas of Rock outcrop consist of exposures of shale.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Norbert soil is western wheatgrass, thickspike wheatgrass, little bluestem, bluebunch wheatgrass, spike fescue, and green needlegrass. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years, 1,800 pounds in favorable years, and 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. Tillage is not recommended.

The Norbert soil is in capability subclass VIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Norbert soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

192—Nuncho loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual

precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam. In the Banner and Big Horn areas small areas of a similar soil that has loamy sand or sand below a depth of 24 inches is included. On the outwash terraces west of Sheridan the Nuncho soil is often underlain by gravel below a depth of 60 inches. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 7 inches thick. The upper 3 inches of the subsoil is light grayish brown clay loam. The next 24 inches is brown clay. The lower part to a depth of 60 inches or more is pale brown clay loam and loam. In some areas the surface layer is silt loam or, in cultivated areas, clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

193—Nuncho loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam. In the Banner and Big Horn areas a small area of a similar soil that has loamy sand or sand below a depth of 40 inches is included. On the outwash terraces west of Sheridan the Nuncho soil is often underlain by gravel below a depth of 60 inches. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 2 inches thick. The upper 4 inches of the subsoil is brown clay loam. The next 14 inches is brown clay. The lower part to a depth of 60 inches or more is very pale brown clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops and livestock grazing.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the

main limitation is the slow permeability. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

194—Nuncho loam, 6 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic in shape and are 25 to 75 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam. In the Banner and Big Horn areas a small area of a similar soil that has loamy sand or sand below a depth of 40 inches is included. On the terraces west of Sheridan the Nuncho soil is often underlain by gravel below a depth of 60 inches. Included areas make up about 15 percent of the map unit. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 4 inches thick. The upper 5 inches of the subsoil is brown clay loam. The next 13 inches is brown clay. The lower part to a depth of 60 inches or more is yellowish brown clay loam. In some cultivated areas the surface layer is clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. If this unit is used for irrigated crops, the slow permeability and the slope are also limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in

unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

195—Nuncho clay loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic in shape and are 15 to 40 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam. Also included in the area between Dayton and Ranchester are small areas of a similar soil that contains more clay than the Nuncho soil. In the Banner and Big Horn areas small areas of a similar soil that has loamy sand or sand below a depth of 24 inches are included. On the outwash terraces west of Sheridan the Nuncho soil is often underlain by layers containing gravel below a depth of 60 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown and dark grayish brown clay loam about 7 inches thick. The upper 11 inches of the subsoil is brown clay. The next 7 inches is brown clay loam. The lower part to a depth of 60 inches or more is pale brown and yellowish brown clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Grazing during wet periods compacts the surface layer, which results in excessive runoff.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

196—Nuncho clay loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic in shape and are 15 to 40 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average

annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam. In the Banner and Big Horn areas small areas of a similar soil that has loamy sand and sand below a depth of 40 inches are included. Also included in the area between Dayton and Ranchester are small areas of a similar soil that contains more clay than the Nuncho soil. On the outwash terraces west of Sheridan the Nuncho soil is often underlain by layers containing gravel below a depth of 60 inches. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

This unit joins the Nunn silty clay loam, 4 to 8 percent slopes, map unit in Montana. The Nunn soils contain slightly more silt than the Nuncho soil in the Sheridan County Area. The two units have no difference in use and management.

Typically, the surface layer is grayish brown clay loam about 12 inches thick. The upper 4 inches of the subsoil is grayish brown clay loam. The next 18 inches is pale brown clay. The lower part to a depth of 60 inches or more is very pale brown clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

197—Nuncho-Emigrant association, 3 to 9 percent slopes. This map unit is on hillslopes and terraces. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Nuncho loam on the lower part of hillslopes and terraces and 30 percent Emigrant clay loam on the upper part of hillslopes.

Included in this unit are small areas of Cedak loam, Recluse loam, Platmak loam, and very deep, reddish brown, clayey soils. Also included are small areas of soils that are dark brown to a depth of 20 or more inches. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Nuncho soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper 8 inches of the subsoil is grayish brown clay loam. The next 13 inches is brown clay. The lower part to a depth of 60 inches or more is pale brown clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Emigrant soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is dark grayish

brown clay loam about 1 inch thick. The upper part of the subsoil is dark grayish brown clay about 8 inches thick. The lower part is brown clay and light brownish gray clay loam about 27 inches thick over soft shale. In some areas the surface layer is loam or, in cultivated areas, clay loam. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Emigrant soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. If this unit is used for irrigated crops, the slow permeability and the slope are also limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

198—Nuncho-Emigrant association, 9 to 15 percent slopes. This map unit is on hillslopes and terraces. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Nuncho loam on terraces and the lower part of hillslopes and 35 percent Emigrant loam on the upper part of hillslopes.

Included in this unit are small areas of Cedak loam, Recluse loam, Platmak loam, and very deep, reddish brown, clayey soils. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Nuncho soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown loam about 2 inches thick. The upper 9 inches of the subsoil is grayish brown clay loam. The next 24 inches is brown clay loam. The lower part to a depth of 60 inches or more is very pale brown clay loam. In cultivated areas the surface layer is commonly clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 Emigrant soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is dark grayish brown loam about 5 inches thick. The upper 7 inches of the subsoil is dark grayish brown clay loam. The next 7 inches is brown clay. The lower part is pale yellow clay loam about 19 inches thick over soft shale.

In some areas the surface layer is clay loam. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Emigrant soil. Available water capacity is moderate. The 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 irrigated hayland and pasture, nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. If this unit is used as irrigated hayland and pasture, the main limitations are the slow permeability and the slope. Maintaining crop residue on or near the surface helps to control runoff and erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

199—Nuncho Variant clay loam, 0 to 6 percent slopes. This very deep, somewhat poorly drained soil is on terraces, alluvial fans, and high flood plains. It formed in alluvium derived from shale. Areas are irregular in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho clay loam, Platsher Variant loam, and Recluse loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown clay loam about 9 inches thick. The upper 10 inches of the subsoil is dark grayish brown and brown clay. The lower part to a depth of 60 inches or more is brown clay loam and grayish brown clay.

Permeability is slow in the Nuncho Variant soil. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 24 to 48 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating water table is at a depth of 2 to 4 feet from May through September. This soil is subject to rare flooding.

This unit is used for irrigated pasture and hay and wildlife habitat.

If this unit is used for irrigated hay and pasture, the main limitation is the slow permeability. The high water table is also a limitation if this unit is used for irrigated alfalfa hay. A sprinkler irrigation system is the most suitable method of applying water. Irrigation water

needs to be applied carefully to prevent the buildup of the water table. Grazing during wet periods compacts the surface layer, which results in excessive runoff.

This map unit is in capability subclass IIIw, nonirrigated and irrigated.

200—Owen Creek-Echemoor-Bynum association, 9 to 30 percent slopes. This map unit is on mountain slopes. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 7,000 to 8,000 feet. The average annual precipitation is 18 to 22 inches, the average annual temperature is 40 to 42 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 35 percent Owen Creek clay loam, 15 to 30 percent slopes, on the lower part of mountain slopes; 30 percent Echemoor silt loam, 9 to 25 percent slopes, on mountain foot slopes; and 20 percent Bynum silt loam, 15 to 30 percent slopes, on the upper part of mountain slopes.

Included in this unit are small areas of Starman channery loam and Nathrop loam. Also included are small areas of shale and limestone rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Owen Creek soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded shale and limestone. Typically, the surface layer is very dark grayish brown clay loam about 3 inches thick. The upper part of the subsoil is dark grayish brown and yellowish brown clay about 15 inches thick. The lower part is very pale brown channery clay loam about 11 inches thick over interbedded soft shale and limestone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Owen Creek soil. Available water capacity is low. The 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 Echemoor soil is moderately deep and well drained. It formed in residuum and alluvium derived from interbedded shale and limestone. Typically, the surface layer is dark brown and dark yellowish brown silt loam about 12 inches thick. The subsoil is grayish brown and light yellowish brown silty clay loam about 17 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Echemoor soil. Available water capacity also is moderate. The 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 Bynum soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded sandstone and shale. Typically, the surface layer is dark grayish brown and grayish brown silt loam about 10 inches thick. The upper 6 inches of the subsoil is light yellowish brown channery clay loam. The lower part is light brownish gray channery clay loam about 12 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Bynum soil. Available water capacity is low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, unpalatable forbs increase. As the ecological further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

201—Parmleed-Bidman association, 3 to 15 percent slopes. This map unit is on hills, terraces, and alluvial fans. Areas are deltaic and irregular in shape and are 50 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet.

The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Parmleed fine sandy loam on hillslopes and hillcrests and 30 percent Bidman fine sandy loam on alluvial fans and terraces.

Included in this unit are small areas of Forkwood loam and Worfka fine sandy loam. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is very pale brown fine sandy loam about 4 inches thick. The upper part of the subsoil is brown clay about 13 inches thick. The lower part is pale brown clay loam about 13 inches thick over soft shale. In some areas the surface layer is loam. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Bidman soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is pale brown fine sandy loam about 2 inches thick. The upper part of the subsoil is yellowish brown clay about 15 inches thick. The next 8 inches is brown clay loam. The lower part to a depth of 60 inches or more is pale brown loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 severe.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion and the low annual precipitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of water erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

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

202—Parmleed-Bidman association, moist, 3 to 9 percent slopes. This map unit is on terraces, alluvial fans, and hillslopes (fig. 5). Areas are deltaic and irregular in shape and are 50 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Parmleed sandy loam on the upper part of hillslopes and 30 percent Bidman loam on alluvial fans, terraces, and the lower part of hillslopes.

Included in this unit are small areas of Worfka fine sandy loam and Platmak loam. Also included in this

unit near Cabin Creek are small areas of a soil that is similar to the Bidman soil but has a sandy surface layer 8 to 13 inches thick. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light brownish gray and light gray sandy loam about 7 inches thick. The upper 11 inches of the subsoil is dark grayish brown and grayish brown clay. The next 4 inches is pale brown silty clay. The next part to a depth of 30 inches is pale brown clay loam. The substratum is light yellowish brown silt loam about 9 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Bidman soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is pale brown loam about 7 inches thick. The upper 11 inches of the subsoil is yellowish brown clay. The next 7 inches is light yellowish brown clay. The lower part to a depth of 60 inches or more is light

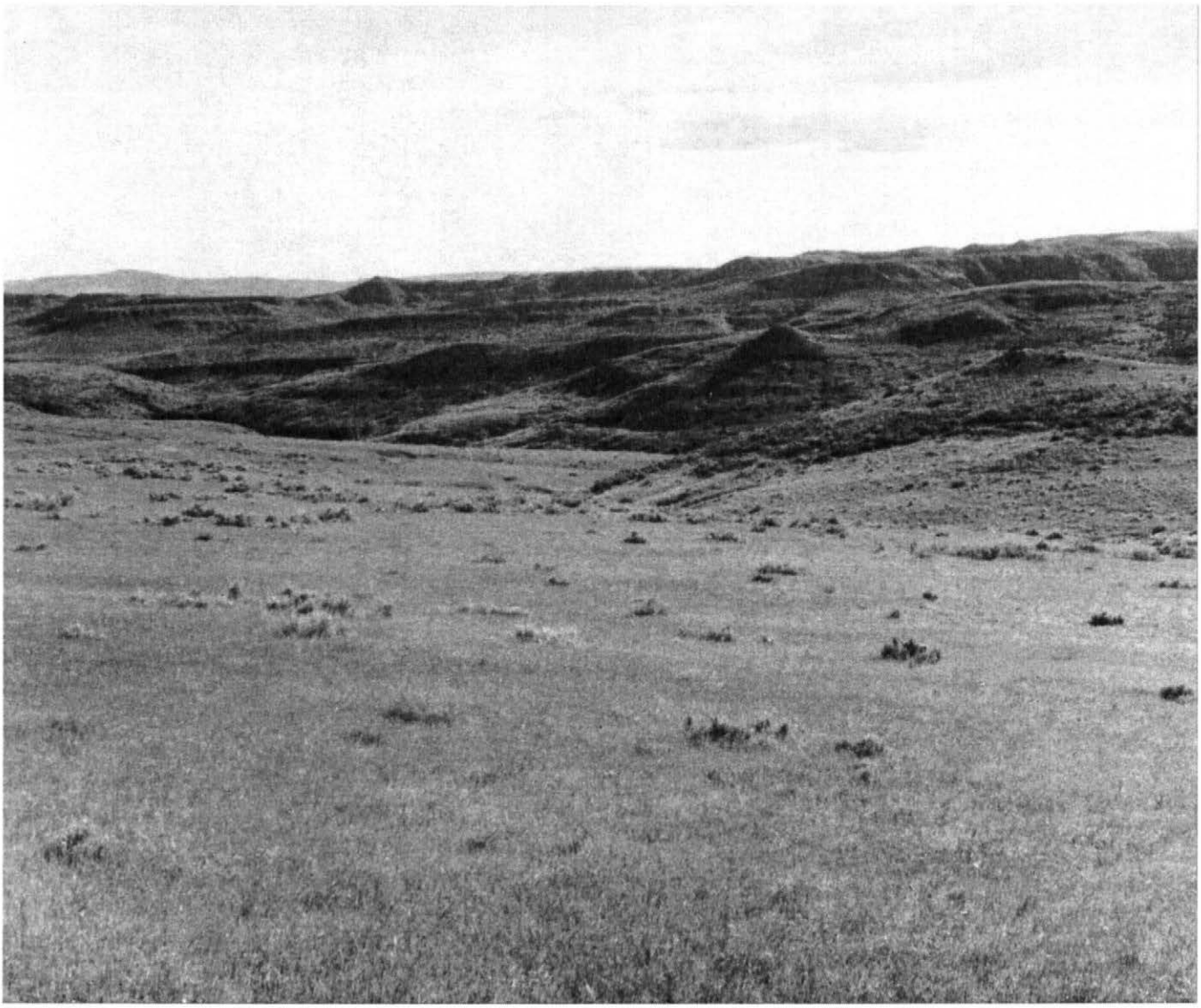


Figure 5.—An area of Parmleed-Bidman association, moist, 3 to 9 percent slopes. Shingle-Theedle-Kishona association, moist, 3 to 30 percent slopes, is in the background.

yellowish brown clay loam. In some cultivated areas the surface layer is clay loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

The Parmleed soil is in capability subclass IVe, nonirrigated, and the Bidman soil is in capability subclass IIIe, nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

203—Parmleed-Bidman association, moist, 9 to 25 percent slopes. This map unit is on terraces and hillslopes. Areas are irregular in shape and are 50 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Parmleed loam, 9 to 25 percent slopes, on the upper part of hillslopes and 35 percent Bidman loam, 9 to 15 percent slopes, on terraces and the lower part of hillslopes.

Included in this unit are small areas of Worfka fine sandy loam and Shingle loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper part of the subsoil is brown clay about 24 inches thick. The lower part is light brownish gray clay loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Bidman soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is pale brown loam about 3 inches thick. The upper part of the subsoil is yellowish brown clay about 12 inches thick. The next 10 inches is brown clay loam. The lower part to a depth of 60 inches or more is light brownish gray clay loam.

Permeability is slow in the Bidman soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition

deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Parmleed soil is in capability subclass VIe, nonirrigated, and the Bidman soil is in capability subclass IVe, nonirrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

204—Parmleed-Renohill complex, 3 to 25 percent slopes. This map unit is on tablelands and hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Parmleed very fine sandy loam, 3 to 15 percent slopes, and 35 percent Renohill clay loam, 3 to 25 percent 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 Bidman loam, Ulm loam, and Worfka fine sandy loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light gray very fine sandy loam about 2 inches thick. The upper 5 inches of the subsoil is brown clay. The next 7 inches is yellowish brown clay. The lower part is pale brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Renohill soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown clay loam about 1 inch thick. The upper part of the subsoil is brown clay about 14 inches thick. The lower part is pale brown clay about 19 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly western wheatgrass, blue grama, needleandthread, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The potential plant community on the Renohill soil is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage

should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Parmleed soil is in capability subclass IVe, nonirrigated, and the Renohill soil is in capability subclass VIe, nonirrigated. The Parmleed soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site. The Renohill soil is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

205—Parmleed-Renohill complex, moist, 3 to 9 percent slopes. This map unit is on hills and tablelands. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Parmleed sandy loam and 35 percent Renohill 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 Bidman loam, Worfka loam, and Ulm loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light brownish gray sandy loam about 7 inches thick. The upper part of the subsoil is dark brown clay about 15 inches thick. The lower part is pale brown clay loam about 16 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Renohill soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is brown clay loam about 2 inches thick. The upper part of the subsoil is yellowish brown clay about 15 inches thick. The lower part is light brownish gray clay loam about 20 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration.

The potential plant community on the Parmleed soil is mainly Idaho fescue, spike fescue, western wheatgrass, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Renohill soil is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Grazing

during wet periods compacts the surface layer, which results in excessive runoff.

This map unit is in capability subclass IVe, nonirrigated. The Parmleed soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Renohill soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

206—Parmleed-Renohill complex, moist, 9 to 25 percent slopes. This map unit is on tablelands and hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Parmleed loam and 40 percent Renohill 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 Bidman loam, Ulm loam, and Worfka loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is brown loam about 3 inches thick. The upper part of the subsoil is brown clay about 21 inches thick. The lower part is pale brown clay loam about 7 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Renohill soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The upper part of the subsoil is grayish brown clay about 12 inches thick. The lower part is light gray clay about 9 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly Idaho fescue, spike fescue, western wheatgrass, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Renohill soil is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIe, nonirrigated. The Parmleed soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Renohill soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

207—Parmleed-Worfka association, 0 to 15 percent slopes. This map unit is on hills and tablelands. Areas are irregular in shape and are 25 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Parmleed fine sandy loam on hillcrests and the lower part of hillslopes and 35 percent Worfka loam on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Bidman loam, Shingle loam, Renohill clay loam, and shale

outcrops. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light gray fine sandy loam about 3 inches thick. The upper part of the subsoil is brown clay about 15 inches thick. The lower part is pale brown clay loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Worfka soil is shallow and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light brownish gray loam about 4 inches thick. The upper part of the subsoil is yellowish brown clay about 6 inches thick. The lower part is light yellowish brown clay loam about 9 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is fine sandy loam.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The potential plant community on the Worfka soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, and blue grama. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The Parmleed soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worfka soil is limited by droughtiness. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Parmleed soil and poor on the Worfka soil. The main limitations affecting seeding are droughtiness in the Worfka soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Parmleed soil is in capability subclass IVe, nonirrigated, and the Worfka soil is in capability subclass VIe, nonirrigated. The Parmleed soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Worfka soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

208—Parmleed-Worfka association, moist, 0 to 9 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Parmleed very fine sandy loam on hillcrests and the lower part of hillslopes and 35 percent Worfka fine sandy loam on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Shingle loam, Bidman fine sandy loam, and shale outcrops. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown very fine sandy loam about 1 inch thick. The subsurface layer is light gray very fine sandy loam about 3 inches thick. The upper part of the subsoil is brown clay about 10 inches thick. The lower part is

pale brown clay loam about 15 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Worfka soil is shallow and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown fine sandy loam about 2 inches thick. The upper part of the subsoil is brown clay about 6 inches thick. The lower part is brown clay about 4 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability is slow in the Worfka soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Worfka soil is mainly Idaho fescue, bluebunch wheatgrass, little bluestem, and needleandthread. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Parmleed soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worfka soil is limited by droughtiness. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is good on the Parmleed soil and poor on the Worfka soil. The main limitation affecting seeding on the Worfka soil is droughtiness.

The Parmleed soil is in capability subclass IVe, nonirrigated, and the Worfka soil is in capability subclass VIe, nonirrigated. The Parmleed soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worfka soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

209—Parmleed-Worfka association, moist, 9 to 25 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Parmleed loam on hillcrests and the lower part of hillslopes and 40 percent Worfka loam on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Shingle loam, Renohill clay loam, Bidman loam, and shale outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is brown loam about 8 inches thick. The upper part of the subsoil is yellowish brown clay about 21 inches thick. The lower part is pale brown clay loam about 3 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The 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 Worfka soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown loam about 1 inch thick. The upper part of the subsoil is yellowish brown clay about 7 inches thick. The lower part is light yellowish brown clay loam about 3 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Worfka soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Worfka soil is mainly Idaho fescue, bluebunch wheatgrass, little bluestem, and needleandthread. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Parmleed soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worfka soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness in the Worfka soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of water erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Parmleed soil is in capability subclass VIe, nonirrigated, and the Worfka soil is in capability subclass VIIe, nonirrigated. The Parmleed soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worfka soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

210—Parmleed-Worfka-Shingle Variant association, moist, 3 to 15 percent slopes. This map unit is on tablelands and hills. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Parmleed loam, 3 to 15 percent slopes, on hillcrests, hillslopes, and tablelands; 25 percent Worfka loam, 3 to 15 percent slopes, on hillcrests; and 20 percent Shingle Variant silt loam, 3 to 6 percent slopes, on hillcrests and tablelands.

Included in this unit are small areas of Bidman loam, Cushman loam, Shingle clay loam, and outcrops of hard sandstone. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Parmleed soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is light brownish gray loam about 2 inches thick. The upper part of the subsoil is brown clay about 14 inches thick. The lower part is light brownish gray clay loam about 19 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Parmleed soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Worfka soil is shallow and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown loam about 2 inches thick. The upper part of the subsoil is yellowish brown clay about 11 inches thick. The lower part is light yellowish brown clay loam about 4 inches thick over shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Worfka soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Shingle Variant soil is shallow and well drained. It formed in residuum and alluvium derived from sandstone and shale. Typically, the surface layer is light yellowish brown silt loam about 2 inches thick. The underlying material is pale brown silt loam about

11 inches thick over hard sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle Variant soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used mainly for livestock grazing and wildlife habitat.

The potential plant community on the Parmleed soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Worfka and Shingle Variant soils is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing on the Worfka and Shingle Variant soils is limited by droughtiness. The Parmleed soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability of the Parmleed soil for rangeland seeding is good. The Worfka and Shingle Variant soils are poorly suited to seeding. The main limitation affecting seeding on the Worfka and Shingle Variant soils is droughtiness.

The Parmleed soil is in capability subclass IVe, nonirrigated, and the Worfka and Shingle Variant soils are in capability subclass VIe, nonirrigated. The Parmleed soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worfka and Shingle Variant soils are in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

211—Peritsa-Abac association, 9 to 35 percent slopes. This map unit is on uplifted dip slopes and hills. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 6,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Peritsa silt loam, 9 to 25 percent slopes, on the lower part of hillslopes and the lower parts of dip slopes and 35 percent Abac silt loam, 9 to 35 percent slopes, on hillcrests and the upper parts of dip slopes.

Included in this unit are small areas of Twin Creek silt loam and a soil that is similar to the Abac soil but has lighter colors. Also included are areas of limestone and siltstone outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Peritsa soil is moderately deep and well drained. It formed in residuum and colluvium derived mainly from shale. Typically, the surface layer is weak red and reddish brown silt loam about 7 inches thick. The upper part of the subsoil is red silty clay loam about 4 inches thick. The lower part is red and light red silt loam about 21 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Peritsa soil. Available water capacity also is moderate. The 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.

The Abac soil is shallow and well drained. It formed in residuum and colluvium derived from interbedded shale and sandstone. Typically, the surface layer is reddish brown and red silt loam about 9 inches thick. The underlying material is light red gravelly loam about 9 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Abac soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Peritsa soil is mainly Idaho fescue, green needlegrass, spike fescue, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Abac soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, green needlegrass, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Peritsa soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Abac soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIe, nonirrigated. The Peritsa soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Abac soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

212—Platmak loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from interbedded sandstone and shale. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho loam and Recluse loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 3 inches thick. The upper 14 inches of the subsoil is brown clay. The next 16 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Permeability is slow in the Platmak soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be

managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

213—Platmak loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from interbedded sandstone and shale. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho loam and Recluse loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 2 inches thick. The upper 11 inches of the subsoil is dark yellowish brown clay loam. The next 4 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is very pale brown loam.

Permeability is slow in the Platmak soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

214—Platmak loam, dry, 0 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from interbedded sandstone and shale. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

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

Typically, the surface layer is brown loam about 5 inches thick. The upper part of the subsoil is brown

clay about 9 inches thick. The lower part to a depth of 60 inches or more is yellowish brown clay loam.

Permeability is slow in the Platmak soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazard of water erosion and the low annual precipitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Chiseling also promotes better aeration. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

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

215—Platsher loam, 0 to 3 percent slopes. This very deep, well drained soil is on outwash terraces. It formed in alluvium derived from sedimentary rock over outwash deposits. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wolfvar loam, Wolf loam, Platsher Variant loam, and Nuncho clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 4 inches thick. The upper 11 inches of the subsoil is brown clay loam. The next 23 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is very pale brown gravelly loam and gravelly clay loam. Depth to the gravelly layer is 20 to 40 inches.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community

produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

216—Platsher loam, 3 to 6 percent slopes. This very deep, well drained soil is on outwash terraces. It formed in alluvium derived from sedimentary rock over outwash deposits. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wolfvar loam, Wolf loam, and Nuncho clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 2 inches thick. The upper part of the subsoil is dark grayish brown clay about 13 inches thick. The next 21 inches is very pale brown clay loam. The lower part to a depth of 60 inches or more is grayish brown gravelly clay loam and gravelly loam. Depth to the gravelly layer is 20 to 40 inches.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for nonirrigated crops, this unit has few limitations. If this unit is used for irrigated crops, the main limitation is the slow permeability. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation, which results in the loss of soil nutrients. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

217—Platsher clay loam, 0 to 3 percent slopes. This very deep, well drained soil is on outwash terraces. It formed in alluvium derived from sedimentary rock over outwash deposits. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wolfvar loam, Wolf loam, Platsher Variant loam, and Nuncho clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown clay loam about 8 inches thick. The upper part of the subsoil is grayish brown clay about 11 inches thick.

The next 8 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is grayish brown gravelly clay loam and gravelly loam.

Permeability is slow in the Platsher soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

218—Platsher clay loam, 3 to 6 percent slopes. This very deep, well drained soil is on outwash terraces. It formed in alluvium derived from sedimentary rock over outwash deposits. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wolfvar loam, Wolf loam, and Nuncho clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil is grayish brown clay about 10 inches thick. The next 10 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is grayish brown gravelly clay loam and gravelly loam. Depth to the gravelly layer is 20 to 40 inches.

Permeability is slow in the Platsher soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases;

therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

219—Platsher-Wolfvar loams, 0 to 3 percent slopes. This map unit is on outwash terraces. Areas are irregular in shape and are 100 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Platsher loam and 35 percent Wolfvar 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 Nuncho loam, Platsher Variant loam, and Wolf loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Platsher soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is grayish brown loam about 7 inches thick. The upper part of the subsoil is grayish brown clay about 14 inches thick. The next 7 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is light gray and grayish brown gravelly clay loam. Depth to the gravelly layer ranges from 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Platsher soil. Available water capacity is high. The 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 Wolfvar soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is brown loam about 2 inches thick. The upper 6 inches of the subsoil is dark yellowish brown clay loam. The next 6 inches is pale brown clay. The lower part to a depth of 37 inches is white gravelly loam. The substratum to a depth of 60 inches or more is white extremely gravelly loamy sand. Depth to the extremely gravelly layer ranges from 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Wolfvar soil. Available water capacity is moderate. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is droughtiness in the Wolfvar soil. If this unit is used for irrigated crops, the slow permeability in both soils is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

220—Platsher-Wolfvar loams, 3 to 6 percent slopes. This map unit is on outwash terraces. Areas are irregular in shape and are 100 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Platsher loam and 35 percent Wolfvar 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 Nuncho loam, Platsher Variant loam, and Wolf loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Platsher soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is dark grayish brown loam about 9 inches thick. The upper 11 inches of the subsoil is dark brown clay loam. The next 17 inches is pale brown clay loam and silty clay loam. The lower part to a depth of 60 inches or more is very pale brown gravelly loam. Depth to the gravelly layer ranges from 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Platsher soil. Available water capacity is high. The 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 Wolfvar soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is grayish brown loam about 2 inches thick. The subsoil is dark grayish brown clay loam about 8 inches thick. The next 6 inches is pale brown clay loam. The next 7 inches is very pale brown gravelly loam. The lower part to a depth of 60 inches or more is light yellowish brown extremely gravelly loamy sand. Depth to the extremely gravelly layer is 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Wolfvar soil. Available water capacity is moderate. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is droughtiness in the Wolfvar soil. If this unit is used for irrigated crops, the slow permeability in both soils is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

221—Platsher-Wolfvar complex, 6 to 9 percent slopes. This map unit is on outwash terraces. Areas are irregular in shape and are 100 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Platsher clay loam and 30 percent Wolfvar 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 Nuncho loam and Wolf loam. Also included are areas on terrace breaks that have slopes of more than 9 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Platsher soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The upper 16 inches of the subsoil is brown clay. The next 21 inches is pale brown silty clay loam. The lower part to a depth of 60 inches or more is cobbly clay loam. Depth to the cobbly layer ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Platsher soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Wolfvar soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is grayish brown loam about 1 inch thick. The upper 5 inches of the subsoil is dark grayish brown clay loam. The next 10 inches is dark brown clay. The next 8 inches is pale brown gravelly clay loam. The lower part to a depth of 60 inches or more is light gray extremely gravelly loamy sand. Depth to the extremely gravelly layer is 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Wolfvar soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitations are droughtiness in the Wolfvar soil and the hazard of water erosion on both soils. If this unit is used for irrigated crops, the slope and the slow permeability in both soils are also limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern affecting seeding is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

222—Platsher Variant loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on outwash terraces. It formed in alluvium derived from sedimentary rock over outwash deposits. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs that tolerate wet soils. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho Variant clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the upper part of the surface layer is dark grayish brown loam about 3 inches thick. The lower part is dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown clay loam. The next 9 inches is light gray silty clay loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam. Depth to the very gravelly layer is 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is slow in the Platsher Variant soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 18 to 36 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A seasonal high water table fluctuates between a depth of 1.5 and 3.0 feet from August through October. It is

the result of the irrigation of this soil and the surrounding soils, the seepage from irrigation ditches, or both.

This unit is used as irrigated hayland and pasture and for livestock grazing and wildlife habitat.

If this unit is used for irrigated hay and pasture, the main limitations are the water table and the slow permeability. Irrigation water needs to be applied carefully to prevent the buildup of the high water table. A drainage system may also be needed. Grazing during wet periods compacts the surface layer, which results in excessive runoff.

The potential plant community on this unit is mainly Nebraska sedge, slender wheatgrass, tufted hairgrass, and spike fescue. The potential plant community produces about 5,000 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 3,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, Canada thistle, foxtail barley, and timothy invade.

The production of vegetation suitable for livestock grazing is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The wetness is the main limitation. It limits the use of mechanical equipment on this soil during the growing season.

This map unit is in capability subclass IIIw, irrigated and nonirrigated, and is in the Subirrigated 15- to 19-inch precipitation zone, Northern Plains range site.

223—Recluse loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces (fig. 6). It formed in alluvium derived from interbedded sedimentary rock. Areas are elongated and deltaic in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is

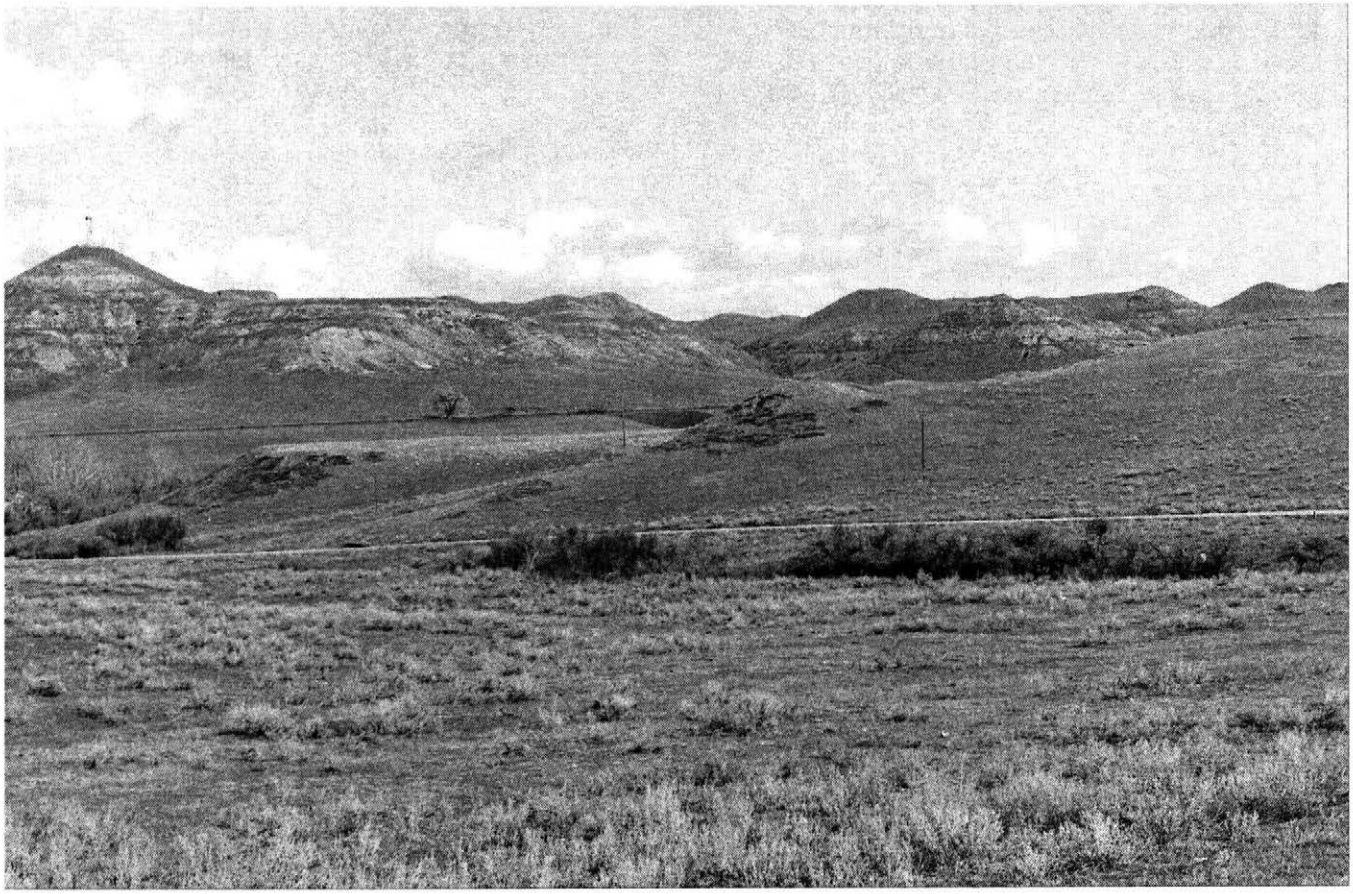


Figure 6.—An area of Recluse loam, 0 to 3 percent slopes. Shingle, moist-Rock outcrop complex, 30 to 50 percent slopes, is in the background.

45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho loam, Moskee sandy loam, Wetterdon loam, and Wolf loam. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 9 inches thick. The upper part of the subsoil is dark yellowish brown clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is brown loam.

Permeability is moderate in the Recluse soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for crops, this unit has few limitations. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

224—Recluse loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from interbedded sedimentary rock. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Nuncho loam, Wetterdon loam, Moskee sandy loam, and Wolf loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 4 inches thick. The upper 9 inches of the subsoil is dark grayish brown clay loam. The next 12 inches is dark yellowish brown clay loam. The lower part to a depth of 60 inches or more is pale brown and light yellowish brown clay loam.

Permeability is moderate in the Recluse soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for crops, this unit has few limitations. Maintaining crop residue on or near the surface helps to control erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per

acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is prime farmland in areas where it is irrigated. This unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

225—Recluse loam, 6 to 9 percent slopes. This very deep, well drained soil is on hillslopes and alluvial fans. It formed in alluvium derived from interbedded sedimentary rock. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Cedak loam, Wetterdon loam, and Moskee sandy loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 4 inches thick. The upper 7 inches of the subsoil is grayish brown clay loam. The next 7 inches is brown clay loam. The lower part to a depth of 60 inches or more is light brownish gray clay loam.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. If this unit is used for irrigated crops, the slope is also a limitation. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

226—Recluse-Bauxson-Baux association, 9 to 30 percent slopes. This map unit is on hillslopes and ridges. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Recluse loam, 9 to 15 percent slopes, on hillslopes; 25 percent Bauxson silt loam, 9 to 30 percent slopes, on back slopes; and 20 percent Baux channery loam, 9 to 30 percent slopes, on ridges.

Included in this unit are small areas of porcellanite and shale rock outcrop, Harlan loam, Kirtley loam, and Cedak loam. Included areas make up about 15 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 sedimentary rock. Typically, the surface layer is brown loam about 14 inches thick. The upper part of the subsoil is brown clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is pale brown clay loam.

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

The Bauxson soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish brown silt loam about 2 inches thick. The subsoil is weak red silty clay loam about 8 inches thick. The substratum to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Bauxson soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is very low. The 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 Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish brown channery loam about 4 inches thick. The next 8 inches is reddish brown very channery loam. The underlying material to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 15 inches.

Permeability in the Baux soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Recluse soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Bauxson soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, spike fescue, and western wheatgrass. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, blue grama, and shrubs increase. As the ecological condition further deteriorates, thistle and gumweed invade.

The Recluse soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Baux and Bauxson soils is limited by droughtiness and the rooting depth. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Recluse soil for rangeland seeding is fair. The main management concern is the hazard

of water erosion. The Baux and Bauxson soils are poorly suited to rangeland seeding. The main limitations are the slope, the rock fragments in the soil, and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

The Recluse soil is in capability subclass IVe, nonirrigated; the Bauxson soil is in capability subclass VIe, nonirrigated; and the Baux soil is in capability subclass VIIe, nonirrigated. The Recluse soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site; the Bauxson soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site; and the Baux soil is in the Very Shallow, 15- to 19-inch precipitation zone, Northern Plains range site.

227—Reeder-Farnuf association, 3 to 9 percent slopes. This map unit is on alluvial fans and hills. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Reeder loam on hillcrests and the upper part of hillslopes and 35 percent Farnuf silt loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Doney loam, Reget silt loam, and Savage silt loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Reeder soil is moderately deep and well drained. It formed in residuum derived from interbedded sedimentary rock. Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The upper part of the subsoil is grayish brown clay loam about 12 inches thick. The lower part is light brownish gray loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

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

The Farnuf soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the upper 2 inches of the surface layer is grayish brown silt loam. The next 9 inches is dark grayish brown silt loam. The upper 5 inches of the subsoil is dark yellowish brown clay loam. The next 5 inches is brown clay loam. The lower part to a depth of 60 inches or more is pale brown loam.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitations are droughtiness in the Reeder soil and the hazard of water erosion and the short growing season of both soils. The slope is also a limitation if this unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of

rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

228—Reeder-Farnuf association, 9 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Reeder loam on hillcrests and the upper part of hillslopes and 30 percent Farnuf silt loam on the lower part of hillslopes.

Included in this unit are small areas of Doney loam, Reget silty clay loam, and Savage silt loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Reeder soil is moderately deep and well drained. It formed in alluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The upper 4 inches of the subsoil is dark grayish brown clay loam. The next 4 inches is brown clay loam. The next part to a depth of 23 inches is pale brown clay loam. The lower part is light brownish gray loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Reeder soil. Available water capacity is moderate. The 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.

The Farnuf soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown silt loam about 2 inches thick. The upper 7 inches of the subsoil is dark grayish brown loam. The next 12 inches is brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

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

This unit is used for irrigated hay and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Reeder soil and the hazard of water erosion and the short growing season of both soils. If this unit is used for irrigated hay, droughtiness in the Reeder soil and the slope, the hazard of water erosion, and the short growing season of both soils are limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

229—Reget silt loam, 0 to 6 percent slopes. This moderately deep, well drained soil is on hills and alluvial fan aprons. It formed in residuum and alluvium derived from shale. Areas are irregular in shape and

are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Savage silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown silt loam about 1 inch thick. The upper part of the subsoil is dark grayish brown clay about 7 inches thick. The lower part is light brownish gray silty clay loam about 15 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is low. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this soil is used for crops, the main limitations are droughtiness and the short growing season. The slow permeability is also a limitation if this soil is used for irrigated crops. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake.

The potential plant community is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

230—Reget clay loam, 6 to 9 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum and alluvium derived from shale. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Savage silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown clay loam about 1 inch thick. The upper 8 inches of the subsoil is grayish brown clay. The lower part is light brownish gray clay about 29 inches thick over moderately hard shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this soil is used for crops, the main limitations are the short growing season, droughtiness, and the hazard of water erosion. The slow permeability is also a limitation if this soil is used for irrigated crops. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if this soil is tilled

during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

231—Reget-Savar association, 3 to 45 percent slopes. This map unit is on hills, alluvial fans, and dip slopes. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Reget clay loam, 3 to 45 percent slopes, on hillcrests and the upper part of hillslopes and 30 percent Savar clay loam, 3 to 35 percent slopes, on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Norbert clay loam and small areas of very gravelly soils on hillcrests. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Reget soil is moderately deep and well drained. It formed in colluvium and alluvium derived from shale. Typically, the surface layer is dark grayish brown clay loam about 1 inch thick. The upper 8 inches of the subsoil is dark grayish brown clay. The lower 27 inches is grayish brown and light brownish gray clay over moderately hard shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The 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 Savar soil is very deep and well drained. It formed in colluvium and alluvium derived from shale. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The upper 18 inches of the subsoil is dark grayish brown and grayish brown clay. The lower part to a depth of 60 inches or more is light gray and light yellowish brown clay.

Permeability is slow in the Savar soil. Available water capacity is high. The 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 mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. The slope, however, limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. The main limitation is the slope.

This map unit is in capability subclass VIe, nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

232—Reget Variant-Reget association, 10 to 65 percent slopes. This map unit is on hills and outwash terraces. Areas are irregular in shape and are 100 to 350 acres in size. The native vegetation is mainly

grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Reget Variant loam, 10 to 35 percent slopes, on hillslopes and outwash terraces and 35 percent Reget loam, 10 to 65 percent slopes, on hillcrests.

Included in this unit are small areas of Farnuf loam, Doney loam, and Savar clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Reget Variant soil is very deep and well drained. It formed in alluvium and colluvium derived from shale and sandstone. Typically, the surface layer is very dark grayish brown and dark brown loam about 9 inches thick. The upper part of the subsoil is dark brown clay loam and strong brown clay about 12 inches thick. The lower part to a depth of 60 inches or more is strong brown and brown sandy clay.

Permeability is slow in the Reget Variant soil. Available water capacity is high. The 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 Reget soil is moderately deep and well drained. It formed in colluvium derived from shale. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The upper 25 inches of the subsoil is yellowish brown clay. The lower part is light yellowish brown clay loam about 6 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is green needlegrass, western wheatgrass, Idaho fescue, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. The slope, however, limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

233—Renohill-Savageton clay loams, 3 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Renohill clay loam and 30 percent Savageton 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 Samday clay loam, Parmleed fine sandy loam, and Wyarno clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is brown clay loam about 1 inch thick. The upper 14 inches of the subsoil is brown clay. The lower part is pale brown clay and clay loam about 22 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion also 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 brown clay loam about 3 inches thick. The upper part of the subsoil is light yellowish brown clay about 13 inches thick. The lower part is light yellowish brown silty clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the low annual precipitation, droughtiness, and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. Grazing during wet periods compacts the surface layer, which results in excessive runoff.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

234—Renohill-Savageton complex, moist, 3 to 10 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Renohill clay loam and 30 percent Savageton silty 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 Samday clay loam, Parmleed fine sandy loam, and Wyarno clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is pale brown clay loam about 3 inches thick. The upper 2 inches of the subsoil is brown clay loam. The next 10 inches is light brownish gray clay. The lower part is light gray clay loam about 17 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also 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 olive brown silty clay loam about 5 inches thick. The upper part of the subsoil is light yellowish brown clay about 17 inches thick. The lower part is pale yellow clay and clay loam about 6 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Savageton soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness and the hazard of water

erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

235—Renohill-Savageton clay loams, moist, 10 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Renohill clay loam and 30 percent Savageton 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 Samday clay loam, Parmleed fine sandy loam, and Wyarno clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The upper part of the subsoil is light yellowish brown clay loam about 16 inches thick. The lower part is light olive brown clay loam about 18 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The 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 Savageton soil is moderately deep and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The upper part of the subsoil is light yellowish brown clay about 21 inches thick. The lower part is light olive brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Savageton soil. Available water capacity is moderate. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer of both soils, droughtiness, and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or

subsoiling breaks up the tillage pan and promotes better aeration.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. 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. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

236—Renohill-Ulm, dry, association, 6 to 15 percent slopes. This map unit is on hills and alluvial fans. Areas are irregular in shape and are 10 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Renohill clay loam on hillcrests and the upper part of hillslopes and 30 percent Ulm clay loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Wyarno clay loam and Samday clay loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is pale brown clay loam about 2 inches thick. The upper 8 inches of the subsoil is pale brown clay. The next 13 inches is very pale brown clay. The lower part is yellowish brown clay loam about 5 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The 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.

The Ulm soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is light brownish gray clay loam about 6 inches thick. The upper 11 inches of the subsoil is grayish brown clay. The next 8 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown clay loam.

Permeability is slow in the Ulm soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Renohill soil and the low annual precipitation, the hazard of water erosion, and the clay loam surface layer of both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in

excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

237—Renohill, moist-Ulm association, 3 to 10 percent slopes. This map unit is on alluvial fans and hills. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Renohill clay loam on hillcrests and the upper part of hillslopes and 30 percent Ulm clay loam on alluvial fans and the lower part of hillslopes.

Included in this unit are small areas of Bidman loam, Shingle loam, and Samday clay loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is brown clay. The next 6 inches is light brownish gray clay loam. The lower part is light yellowish brown clay loam about 23 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Ulm soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is pale brown clay loam about 3 inches thick. The upper 11 inches of the subsoil is pale brown clay loam and clay. The next 13 inches is very pale brown clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam.

Permeability is slow in the Ulm soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Renohill soil and the hazard of water erosion and the clay loam surface layer of both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of

erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake.

The Renohill soil is in capability subclass IVe, nonirrigated, and the Ulm soil is in capability subclass IIIe, nonirrigated. This map unit is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

238—Renohill-Worfka association, 6 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Renohill clay loam on hillslopes and 35 percent Worfka clay loam on hillcrests.

Included in this unit are small areas of Shingle clay loam, Samday clay loam, and Ulm loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 2 inches thick. The upper 10 inches of the subsoil is light brownish gray clay loam. The next 4 inches is brown clay. The lower part is grayish brown clay loam about 9 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Renohill soil. Available water capacity is low. The 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.

The Worfka soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 4 inches thick. The upper part of the subsoil is brown clay about 8 inches thick. The lower part is light olive brown clay loam about 5 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Worfka soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Renohill soil is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

The potential plant community on the Worfka soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. 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. As the ecological condition deteriorates, big sagebrush and birdfoot sagebrush increase. As the ecological condition further deteriorates, broom snakeweed and annuals invade.

The Renohill soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worfka soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Renohill soil for rangeland seeding is fair. The Worfka soil is poorly suited to rangeland seeding. The main limitations are droughtiness in the Worfka soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Renohill soil is in capability subclass IVe, nonirrigated, and the Worfka soil is in capability subclass VIe, nonirrigated. The Renohill soil is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site, and the Worfka soil is in the Shallow Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

239—Renohill-Worfka association, moist, 3 to 20 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual

precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Renohill clay loam on hillslopes and 30 percent Worfka clay loam on hillcrests.

Included in this unit are small areas of Shingle clay loam, Samday clay loam, and Ulm loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in alluvium and residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The upper part of the subsoil is grayish brown clay about 14 inches thick. The next 8 inches is brown clay. The lower part is brown clay loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Renohill soil. Available water capacity is moderate. The 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 Worfka soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The upper 10 inches of the subsoil is grayish brown clay. The lower 6 inches is gray clay loam over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability is slow in the Worfka soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Renohill soil is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

The potential plant community on the Worfka soil is mainly western wheatgrass, little bluestem, green needlegrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The Renohill soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Worfka soil is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Renohill soil for rangeland seeding is fair. The Worfka soil is poorly suited to rangeland seeding. The main limitations are droughtiness in the Worfka soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass VIe, nonirrigated. The Renohill soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site, and the Worfka soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

240—Renohill, moist-Wyarno association, 6 to 9 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Renohill clay loam on hillcrests and the upper part of hillslopes and 30 percent Wyarno clay loam on the lower part of hillslopes.

Included in this unit are small areas of Shingle loam and Samday clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Renohill soil is moderately deep and well drained. It formed in residuum and alluvium derived from shale. Typically, the surface layer is grayish brown clay loam about 4 inches thick. The upper part of the subsoil is brown clay loam about 14 inches thick. The lower part is very pale brown clay loam about 9 inches thick over soft shale. Depth to bedrock

ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Renohill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Wyarno soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is brown clay loam about 2 inches thick. The upper 14 inches of the subsoil is pale brown clay. The next 26 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is loam.

Permeability is slow in the Wyarno soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitations are droughtiness in the Renohill soil and the clay loam surface layer and the hazard of water erosion in both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

241—Rock outcrop-Agneston-Rubble land association, 20 to 50 percent slopes. This map unit is on mountain slopes, escarpments, and canyon walls at the base of the Big Horn Mountains. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly coniferous trees and grasses. The canopy cover on the Agneston soil is 75 to 100 percent. Elevation is 5,000 to 6,800 feet. The average annual precipitation is 20 to 30 inches, the average annual temperature is 39 to 41 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 35 percent areas of Rock outcrop on escarpments and canyon walls; 30 percent Agneston sandy loam, 20 to 50 percent slopes, on mountain foot slopes; and 20 percent areas of Rubble land on mountain foot slopes and toe slopes.

Included in this unit are small areas of Granile gravelly sandy loam and Starman channery loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The areas of Rock outcrop consist of exposures of granite, limestone, and sandstone.

The Agneston soil is moderately deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface is covered with organic litter about 3 inches thick. The surface layer is light brownish gray sandy loam about 5 inches thick. The subsoil is yellowish brown very gravelly sandy clay loam about 13 inches thick. The substratum is pale brown very gravelly sandy loam about 5 inches thick over granite. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Agneston soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

Rubble land consists of areas of loose limestone and granitic rock fragments several feet deep. These areas support no vegetation.

This unit is used for livestock grazing and wildlife habitat.

The principal vegetation on the Agneston soil is mainly an overstory of Douglas-fir, Engelmann spruce, ponderosa pine, and limber pine with an understory of Saskatoon serviceberry, Oregongrape, common juniper, heartleaf arnica, and bedstraw.

The production of vegetation suitable for livestock grazing on the Agneston soil is limited by the canopy cover. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

The slope and the areas of Rock outcrop and Rubble land limit access for harvesting timber on this unit.

The areas of Rock outcrop and Rubble land are in capability class VIII, and the Agneston soil is in capability subclass VIIe, nonirrigated. The Agneston soil is a woodland site.

242—Rock outcrop-Starman association, 15 to 45 percent slopes. This map unit is on mountain slopes, canyon walls, and escarpments. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs with scattered ponderosa pine. The canopy cover on the Starman soil is 10 to 15 percent. Elevation is 5,500 to 6,500 feet. The average annual precipitation is 19 to 25 inches, the average annual temperature is 41 to 43 degrees F, and the average frost-free period is 50 to 80 days.

This unit is 50 percent areas of Rock outcrop on escarpments and canyon walls and 30 percent Starman channery clay loam, 15 to 45 percent slopes, on mountain back slopes and foot slopes.

Included in this unit are small areas of Agneston sandy loam, Cloud Peak gravelly silt loam, and Bynum silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The areas of Rock outcrop consist of exposures of limestone and sandstone.

The Starman soil is shallow and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is pale brown channery clay loam about 4 inches thick. The subsoil is very pale brown very channery clay loam about 10 inches thick over fractured limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Starman soil. Available water capacity is very low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Starman soil is mainly Columbia needlegrass, Idaho fescue, Montana wheatgrass, spike fescue, and a few ponderosa pine. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations are the slope and the areas of Rock outcrop.

The areas of Rock outcrop are in capability class VIII, and the Starman soil is in capability subclass VIIe, nonirrigated. The Starman soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site.

243—Rock outcrop-Starman Variant association, 10 to 70 percent slopes. This map unit is on mountain back slopes, escarpments, and canyon walls. Areas are irregular in shape and are 100 to 200 acres in size. The native vegetation is mainly grasses and shrubs with occasional ponderosa pine. The canopy cover on the Starman Variant soil is 10 to 15 percent. Elevation is 4,000 to 6,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent areas of Rock outcrop on escarpments and canyon walls that have nearly vertical slopes and 35 percent Starman Variant very channery loam on mountain back slopes.

Included in this unit are small areas of Agneston sandy loam and moderately deep and deep, extremely channery soils on toe slopes. Also included in this unit are small areas of Rubble land occurring as talus slopes below escarpments. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The areas of Rock outcrop consist of exposures of limestone and sandstone.

The Starman Variant soil is shallow and well drained. It formed in residuum and colluvium derived from limestone. Typically, the surface layer is pale brown very channery loam about 3 inches thick. The underlying material is light yellowish brown extremely channery loam about 11 inches thick over limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Starman Variant soil. Available water capacity is very low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Starman Variant soil is Columbia needlegrass, Idaho fescue, Montana wheatgrass, spike fescue, and a few ponderosa pine. The potential plant community produces about 950 pounds of air-dry vegetation in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations are the slope and the areas of Rock outcrop.

The areas of Rock outcrop are in capability class VIII, and the Starman Variant soil is in capability subclass VIIe, nonirrigated. The Starman Variant soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site.

244—Samday-Gayhart-Hilight clay loams, moist, 2 to 60 percent slopes. This map unit is on hills. Areas are irregular in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent Samday clay loam, 25 percent Gayhart clay loam, and 20 percent Hilight 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 rock outcrop and Bahl clay loam. Included areas make up about 20 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 and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 2 inches thick. The underlying material is grayish brown clay about 12 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 Gayhart soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light brownish gray clay loam about 2 inches thick. The underlying material is light brownish gray clay about 30 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Gayhart soil. Available water capacity is low. The 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 Hilight soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is gray clay loam about 1 inch thick. The underlying material is grayish brown clay about 11 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Samday and Hilight soils is mainly western wheatgrass, little bluestem, green needlegrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Gayhart soil is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

The production of vegetation suitable for livestock grazing on the Samday and Hilight soils is limited by droughtiness and the rooting depth. The Gayhart soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Samday and Hilight soils are in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site, and the Gayhart soil is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

245—Samday-Hilight clay loams, 2 to 45 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Samday clay loam and 35 percent Hilight 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 rock outcrop, Shingle clay loam, Gayhart clay loam, and Savageton clay loam. Included areas make up about 20 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 and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 2 inches thick. The underlying material is grayish brown clay about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 Hilight soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 1 inch thick. The underlying material is light gray silty clay about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Hilight soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. 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. As the ecological condition deteriorates, big sagebrush and birdfoot sagebrush increase. As the ecological condition further deteriorates, broom snakeweed and annuals invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is in the Shallow Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

246—Savage loam, 0 to 6 percent slopes. This very deep, well drained soil is on terraces and alluvial fans.

It formed in alluvium derived from shale. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Farnuf silt loam and soils that are similar to the Savage soil but have a thicker surface layer. Also included in the Story area are soils that are similar to the Savage soil but have a thick, clayey surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown loam about 11 inches thick. The upper 12 inches of the subsoil is yellowish brown clay. The lower part to a depth of 60 inches or more is very pale brown silty clay loam. In cultivated areas the surface layer is clay loam or silty clay loam.

Permeability is slow in the Savage soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the short growing season. If this soil is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

247—Savage silt loam, 6 to 9 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from shale. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Farnuf silt loam, Reget silt loam, and a soil that is similar to the Savage soil but has a thicker surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is brown silty clay loam about 13 inches thick. The next 10 inches is light gray silty clay. The lower part to a depth of 60 inches or more is light gray silty clay loam. In cultivated areas the surface layer is clay loam or silty clay loam.

Permeability is slow in the Savage soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitations are the short growing season and the hazard of water erosion. If this soil is used for irrigated crops, the slow permeability and the slope are also limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Maintaining crop residue on or near the surface helps to control runoff and erosion. Tillage should be on the contour or across the slope. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize

surface runoff. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

248—Savage silt loam, 9 to 15 percent slopes. This very deep, well drained soil is on hillslopes. It formed in alluvium derived from shale. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Reget silt loam, Reeder silt loam, and Farnuf silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is brown silty clay loam about 13 inches thick. The next 8 inches is light gray silty clay. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Permeability is slow in the Savage soil. Available water capacity is high. The 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 irrigated and nonirrigated hay and pasture, nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the short growing season and the hazard of water erosion. If this soil is used for irrigated hay and pasture, the short growing season, the slow permeability, and the slope are limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion. Tillage should be on the contour or across the slope. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is spike fescue, green needlegrass, western wheatgrass, and Idaho fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass VIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

249—Savage-Farnuf silt loams, gravelly substratum, 0 to 6 percent slopes. This map unit is on terraces. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Savage silt loam and 30 percent Farnuf silt 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 Savage silt loam and Farnuf loam. Also included are areas of soils that are similar to the Savage and Farnuf soils but have a gravelly layer 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 Savage soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over gravelly mountain outwash. Typically, the surface layer is dark grayish brown silt loam about 14 inches thick. The upper 15 inches of the subsoil is brown clay. The next 12 inches is grayish brown clay. The lower part to a depth of 60 inches or more is very pale brown gravelly silt loam. Depth to the very gravelly layer is 40 to 60 inches. In some areas the surface layer is fine sandy loam or loam. In cultivated areas this soil has a silty clay loam surface layer.

Permeability is slow in the Savage soil. Available water capacity is high. The 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 Farnuf soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over gravelly mountain outwash. Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The upper 9 inches of the subsoil is dark brown silty clay loam. The next 6 inches is pale brown silt loam. The lower part to a depth of 60 inches or more is white gravelly silt loam. In cultivated areas this soil has a silty clay loam surface layer. In some areas the surface layer is loam. This soil contains more calcium carbonate in the lower layers of the subsoil than allowed for the Farnuf series. This difference, however, does not significantly affect the use or management of this soil.

Permeability is moderate in the Farnuf soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the short growing season. The slow permeability in the Savage soil is also a limitation if this unit is used for irrigated crops. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes better aeration.

The potential plant community on this unit is mainly Idaho fescue, green needlegrass, western wheatgrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

250—Savage-Korchea loams, 0 to 3 percent slopes. This map unit is on flood plains and terraces. Areas are elongated and sinuous in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs and a few cottonwood trees. The canopy cover is 0 to 25 percent. Elevation is 3,900 to 4,200 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Savage loam and 30 percent Korchea loam. The Savage soil is on terraces, and the Korchea soil is on flood plains. 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 Farnuf silt loam, Savar clay loam, and a poorly drained, clayey soil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Savage soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is dark brown loam about 3 inches thick. The upper part of the subsoil is dark brown clay about 11 inches thick. The next 7 inches is yellowish brown silty clay loam. The lower part to a depth of 60 inches or more is light olive brown silty clay loam.

Permeability is slow in the Savage soil. Available water capacity is high. The 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 Korchea soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is grayish brown loam about 13 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, light brownish gray, and light yellowish brown, stratified loam, silt loam, and very fine sandy loam. This soil is outside the range of the Korchea series because the surface layer is thicker than allowed for the series. This difference, however, does not significantly affect the use and management of this soil.

Permeability is moderate in the Korchea soil. Available water capacity is high. The 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 occasional flooding for brief periods from May through June.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for nonirrigated hay and pasture.

If this unit is used for nonirrigated hay and pasture, the main limitations are the short growing season of both soils, the hazard of flooding on the Korchea soil, and the slow permeability in the Savage soil. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on the Savage soil is Idaho fescue, green needlegrass, spike fescue, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Korchea soil is green needlegrass, western wheatgrass, basin wildrye, Columbia needlegrass, and a few cottonwood trees. The potential plant community produces about 3,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,000 pounds in favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass and annuals invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, nonirrigated. The Savage soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Korchea soil is in the Overflow, 15- to 19-inch precipitation zone, Northern Plains range site.

251—Savage-Reget association, 4 to 30 percent slopes. This map unit is on alluvial fans, terraces, and hills. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 4,500 feet. The average annual precipitation is 15 to 19 inches, the

average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Savage silt loam, 4 to 15 percent slopes, on terraces, alluvial fans, and the lower part of hillslopes and 35 percent Reget silt loam, 8 to 30 percent slopes, on hillcrests and the upper part of hillslopes.

Included in this unit are small areas of Norbert silty clay, Reeder silt loam, Savar clay loam, and Farnuf silt loam. Also included are areas of very deep, clayey soils that are dark brown to a depth of 20 to 25 inches and gravelly soils on hillcrests. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Savage soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown and dark brown silt loam about 10 inches thick. The upper part of the subsoil is brown silty clay and silty clay loam about 11 inches thick. The lower part to a depth of 60 inches or more is pale brown and light gray silty clay loam. In cultivated areas the surface layer of this soil is silty clay loam.

Permeability is slow in the Savage soil. Available water capacity is high. The 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 Reget soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is dark brown silt loam about 9 inches thick. The upper part of the subsoil is dark yellowish brown clay about 17 inches thick. The lower part is pale brown clay loam about 12 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Reget soil. Available water capacity is moderate. The 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 mainly for livestock grazing and wildlife habitat. In some areas the Savage soil is also used for nonirrigated crops.

The Reget soil is not suited to cropland because of the slope and the hazard of water erosion. If the Savage soil is used for nonirrigated crops, the main management concern is the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. A tillage pan forms easily if these soils are tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan and promotes aeration.

The potential plant community on this unit is mainly Idaho fescue, western wheatgrass, spike fescue, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years, 3,000 pounds in favorable years, and 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability for rangeland seeding is fair on the Savage soil and poor on the Reget soil. The main limitations are the slope on the Reget soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Savage soil is in capability subclass IVe, nonirrigated, and the Reget soil is in capability subclass VIe, nonirrigated. This map unit is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

252—Searing-Ringling association, 2 to 75 percent slopes. This map unit is on hills, in swales, and on ridges. Areas are elongated and irregular in shape and are 100 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Searing loam, 2 to 15 percent slopes, in swales between hills and on the lower part of hillslopes and ridges and 30 percent

Ringling channery loam, 5 to 75 percent slopes, on hillcrests and the upper part of hillslopes and ridges.

Included in this unit are small areas of Reeder loam, Farnuf loam, and porcellanite outcrop. Included areas make up about 25 percent of the total acreage. Percentages vary from one area to another.

The Searing soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is dark brown loam about 2 inches thick. The upper part of the subsoil is dark brown and dark yellowish brown clay loam about 13 inches thick. The lower 23 inches is pinkish gray loam. The substratum to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 20 to 40 inches. This soil is outside the characteristics defined for the Searing series because the upper part of the subsoil contains appreciable amounts of clay that were moved from the surface layer by the downward movement of water. This difference does not significantly affect the use and management of the soil.

Permeability in the Searing soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Ringling soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is reddish brown channery loam about 8 inches thick. The upper 8 inches of the underlying material is light reddish brown very channery loam. The lower part to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Ringling soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The 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.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Searing soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Ringling soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The Searing soil has few limitations affecting plants that are suitable for livestock grazing. The production of vegetation suitable for livestock grazing on the Ringling soil is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Searing soil is in capability subclass IVe, nonirrigated, and the Ringling soil is in capability subclass VIIe, nonirrigated. The Searing soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Ringling soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

253—Shaak loam, 0 to 6 percent slopes. This very deep, well drained soil is on alluvial fans, terraces, and toe slopes. It formed in alluvium derived from interbedded shale and sandstone. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Savage silt loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown loam about 9 inches thick. The upper 5 inches of the

subsoil is grayish brown clay. The next 4 inches is yellowish brown clay. The lower part to a depth of 60 inches or more is light brownish gray clay.

Permeability is slow in the Shaak soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the short growing season. The slow permeability is also a limitation if this soil is used for irrigated crops. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone yet minimize surface runoff. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is Idaho fescue, green needlegrass, western wheatgrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

254—Shingle, moist-Baux-Rock outcrop complex, 30 to 60 percent slopes. This map unit is on escarpments and ridges. Areas are irregular in shape and are 20 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Shingle loam, 30 to 60 percent slopes; 30 percent Baux loam, 30 to 60 percent slopes; and 25 percent areas of 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 Theedle loam, Kishona loam, Wibaux channery loam, and Bauxson channery loam. 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 and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown loam about 4 inches thick. The underlying material is light olive gray clay loam about 11 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is fine sandy loam and the underlying material is loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Baux soil is very deep and well drained. It formed in residuum and colluvium derived from porcellanite. Typically, the upper part of the surface layer is reddish brown loam about 5 inches thick. The lower 7 inches is reddish brown very channery loam. The underlying material to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 12 to 20 inches.

Permeability in the Baux soil is moderate in the subsoil and very rapid in the underlying material. Available water capacity is very low. The 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 areas of Rock outcrop consist of exposures of interbedded shale, siltstone, sandstone, and porcellanite. The porcellanite beds vary in thickness from a few feet to 20 or more feet. Because of the slope, porcellanite fragments commonly move down the hillside and cover the underlying shale beds with a thin mantle.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Baux soil is mainly bluebunch wheatgrass, little bluestem, spike fescue, and western wheatgrass. The potential plant community produces about 700 pounds of air-dry vegetation per acre in normal years. Production varies from 900 pounds in favorable years to 400 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, blue grama, and shrubs increase. As the ecological condition further deteriorates, thistle and gumweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the limited rooting depth. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation is the slope.

The Shingle and Baux soils are in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Baux soil is in the Very Shallow, 15- to 19-inch precipitation zone, Northern Plains range site.

255—Shingle-Haverdad association, 0 to 80 percent slopes. This map unit is on the sides and floors of gullies that have a depth of 6 to 20 or more feet and a width of 10 to 25 or more feet. This unit generally originates at the base of the topographically higher terrace escarpments and dissects the lower valley filling hillslopes and alluvial fans leading to major drainageways. Areas are elongated and sinuous in shape and are 10 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Shingle clay loam, 6 to 80 percent slopes, on hillslopes at the heads of drainageways and on the sides of gullies and 35 percent Haverdad loam, 0 to 6 percent slopes, on the floors of gullies.

Included in this unit are small areas of Draknab loamy fine sand, Samday clay loam, and rock outcrop. Included areas make up about 20 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 and colluvium derived from sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 1 inch thick. The underlying material is light yellowish brown clay loam about 14 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Haverdad soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified lenses of light yellowish brown, pale brown, and light brownish gray fine sandy loam, clay loam, loam, loamy sand, and silt loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Haverdad soil is mainly basin wildrye, western wheatgrass, Canby bluegrass, and green needlegrass. 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. As the ecological condition deteriorates, blue grama and woody plants increase. As the ecological condition further deteriorates, annuals invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness and the rooting depth. The slope of this soil limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Shingle soil for rangeland seeding is poor. The main limitation affecting seeding is the slope. The suitability of the Haverdad soil for rangeland seeding is good; however, the adjacent slopes limit access for rangeland seeding in areas of the Haverdad soil.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the Haverdad soil is in capability subclass Vw, nonirrigated. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Haverdad soil is in the Overflow, 10- to 14-inch precipitation zone, Northern Plains range site.

256—Shingle-Haverdad association, moist, 0 to 80 percent slopes. This map unit is on the sides and floors of gullies that have a depth of 6 to 20 or more feet and a width of 10 to 25 or more feet. It generally originates at the base of the topographically higher terrace or rock outcrop escarpments and dissects the lower valley filling hillslopes and alluvial fans leading to major drainageways. Areas are elongated and sinuous in shape and are 10 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Shingle clay loam, 6 to 80 percent slopes, on hillslopes at the heads of drainageways and on the sides of gullies and 35 percent Haverdad very fine sandy loam, 0 to 6 percent slopes, on the floors of gullies.

Included in this unit are small areas of Draknab loamy fine sand, Samday clay loam, and rock outcrop. Included areas make up about 20 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 and colluvium derived from sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Haverdad soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is light brownish gray very fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches is stratified light yellowish brown, pale brown, and light brownish gray fine sandy loam, clay loam, loamy sand, and silt loam.

Permeability is moderate in the Haverdad soil. Available water capacity is high. The 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 frequent flooding for brief periods from March through June.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Haverdad soil is mainly green needlegrass, western wheatgrass, basin wildrye, slender wheatgrass, and Columbia needlegrass. The potential plant community produces about 3,000 pounds of air-dry vegetation per acre in normal years. Production varies from 4,000 pounds in

favorable years to 2,000 pounds in unfavorable years. As the ecological condition deteriorates, American licorice, western yarrow, and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass and annuals invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness and the rooting depth. The slope of this soil limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of the Shingle soil for rangeland seeding is poor. The main limitation affecting seeding is the slope. The suitability of the Haverdad soil for rangeland seeding is good; however, the adjacent slopes limit access for rangeland seeding in areas of the Haverdad soil.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the Haverdad soil is in capability subclass Vw, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Haverdad soil is in the Overflow, 15- to 19-inch precipitation zone, Northern Plains range site.

257—Shingle-Nihill complex, 3 to 80 percent slopes. This map unit is on hillslopes, terrace breaks, and terraces. In some areas the terraces are dissected by numerous, deep drainageways. Areas are irregular in shape and are 10 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Shingle clay loam, 3 to 80 percent slopes, and 35 percent Nihill gravelly loam, 6 to 80 percent slopes. The Shingle soil is on the upper part of hillslopes and terrace breaks. The Nihill soil is on terraces and the lower part of hillslopes and terrace breaks. 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, Theedle loam, Samday clay loam, Taluce sandy loam, Wolf loam, and Big Horn loam. In some areas cobbles, boulders, or both may be on the surface of these soils. In the Clearmont area inclusions of very deep, sandy soils occur. Included areas make up about 25 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 and colluvium derived from sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. Where the Shingle soil occurs on side slopes, a thin mantle of colluvial gravel is common on the surface.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Nihill soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown gravelly loam about 5 inches thick. The upper 24 inches of the subsoil is yellowish brown very gravelly sandy clay loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly loam.

Permeability is moderate in the Nihill soil. Available water capacity is low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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 400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

258—Shingle-Nihill complex, moist, 3 to 80 percent slopes. This map unit is on hillslopes, terrace breaks, and terraces. In some areas the terraces are dissected by numerous, deep drainageways. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Shingle loam and 35 percent Nihill gravelly loam. The Shingle soil is on the upper part of hillslopes and terrace breaks. The Nihill soil is on terraces and the lower part of hillslopes and terrace breaks. 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, Theedle loam, Cushman loam, Wolf loam, and Wolfvar clay loam. In some areas boulders, cobbles, or both may be on the surface of these soils. Included areas make up about 25 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 and alluvium derived from sedimentary rock. Typically, the surface layer is brown loam about 4 inches thick. The underlying material is pale brown loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. Where the Shingle soil occurs on side slopes, a thin mantle of colluvial gravel is common on the surface.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Nihill soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown gravelly loam about 5 inches thick. The upper 24 inches of the subsoil is light yellowish brown very gravelly clay loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy clay loam.

Permeability is moderate in the Nihill soil. Available water capacity is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

259—Shingle, moist-Nuncho association, 3 to 45 percent slopes. This map unit is on hillslopes and elongated, narrow alluvial fans. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Shingle loam, 3 to 45 percent slopes, on hillcrests and the upper part of hillslopes and 30 percent Nuncho loam, 3 to 9 percent slopes, on alluvial fans and the lower part of hillslopes (fig. 7).

Included in this unit are small areas of Theedle loam, Emigrant clay loam, and Recluse loam. Also included are areas of shale outcrop on ridges and knolls. Included areas make up about 25 percent of the total acreage. Percentages vary from one area to another.

The Shingle soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is brown loam about 4 inches thick. The underlying material is pale brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is gravelly loam or clay loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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.

Figure 7.—An area of Shingle, moist-Nuncho association, 3 to 45 percent slopes. The Shingle soil is on the hills in the background, and the Nuncho soil is in the less sloping area in the foreground.

The Nuncho soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper 8 inches of the subsoil is dark brown clay loam. The next 13 inches is brown clay loam. The underlying material to a depth of 60 inches or more is pale brown clay loam and loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is Idaho fescue, bluebunch wheatgrass, western wheatgrass, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Nuncho soil is Idaho fescue, green needlegrass, needleandthread, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness.

The slope of the Shingle soil limits access by livestock and results in overgrazing in the more accessible areas. The Nuncho soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management on the Nuncho soil improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland on the Nuncho soil. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability of the Shingle soil for rangeland seeding is poor. The main limitation affecting seeding is the slope. The suitability of the Nuncho soil for rangeland seeding is good; however, the adjacent slopes limit access for reseeding or range renovation in areas of the Nuncho soil.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the Nuncho soil is in capability subclass IIIe, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Nuncho soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

260—Shingle-Rock outcrop complex, 30 to 50 percent slopes. This map unit is on escarpments and hills. Areas are irregular in shape and are 10 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle clay loam, 30 to 50 percent slopes, on hillcrests and hillslopes and 30 percent areas of Rock outcrop on escarpments. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kishona loam, Theedle loam, and Samday clay loam. Included areas make up about 20 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 and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 1 inch thick. The underlying material is light yellowish brown clay loam about 14 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 areas of Rock outcrop consist of exposures of interbedded shale, siltstone, sandstone, and small areas of porcellanite.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

261—Shingle, moist-Rock outcrop complex, 30 to 50 percent slopes. This map unit is on terrace escarpments and ridges (fig. 6). Areas are irregular in shape and are 10 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Shingle clay loam, 30 to 50 percent slopes, and 30 percent areas of 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 Kishona loam, Theedle loam, and Samday clay loam. Included areas make up about 25 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 and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The underlying material is grayish brown clay loam about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 areas of Rock outcrop consist of exposures of interbedded shale, siltstone, sandstone, and small areas of porcellanite.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the areas of Rock outcrop are in capability class VIII. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

262—Shingle-Samday clay loams, 6 to 60 percent slopes. This map unit is on ridges and hills. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Shingle clay loam, 6 to 55 percent slopes, and 35 percent Samday clay loam, 6 to 60 percent 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 Theedle loam, Gayhart clay loam, and rock outcrop. Included areas make up about 20 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 and colluvium derived from shale. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is silt loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Samday soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 4 inches thick. The underlying material is light brownish gray silty clay about 12 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Samday soil is mainly western wheatgrass, green needlegrass, and bluebunch wheatgrass. 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. As the ecological condition deteriorates, big sagebrush and birdfoot sagebrush increase. As the ecological condition further deteriorates, broom snakeweed and annuals invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site. The Samday soil is in the Shallow Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

263—Shingle-Samday clay loams, moist, 3 to 55 percent slopes. This map unit is on hills and ridges. Areas are irregular in shape and are 10 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Shingle clay loam and 35 percent Samday 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 Theedle loam, Gayhart clay loam, and rock outcrop. Included areas make up about 25 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 and colluvium derived from shale. Typically, the surface layer is olive brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 10 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is silt loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Samday soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is very pale brown clay loam about 2 inches thick. The underlying material is very pale brown clay about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is clay.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Samday soil is mainly western wheatgrass, little bluestem, green needlegrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site. The Samday soil is in the Shallow Clayey,

15- to 19-inch precipitation zone, Northern Plains range site.

264—Shingle-Taluce complex, 9 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle clay loam and 30 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 rock outcrop and Tullock fine sandy loam. Included areas make up about 20 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 light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is silt loam or fine sandy loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Taluce soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is light olive brown fine sandy loam about 4 inches thick. The underlying material is light gray fine sandy loam about 15 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, and little bluestem. 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. As the ecological condition deteriorates, threadleaf sedge, yucca, and fringed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Shingle soil is in capability subclass VIe, nonirrigated, and the Taluce soil is in capability subclass VIIs, nonirrigated. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

265—Shingle-Taluce complex, moist, 9 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle loam and 30 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 rock outcrop, Tullock sandy loam, Lambman sandy loam, and Theedle loam. Included areas make up about 20 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 brown loam about 1 inch thick. The underlying material is light brownish gray loam about 16 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is fine sandy loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Taluce soil is shallow and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is light olive brown fine sandy loam about 4 inches thick. The underlying material is light gray fine sandy loam about 15 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Taluce soil is mainly prairie sandreed, needleandthread, western wheatgrass, and bluebunch wheatgrass. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and annuals invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazards of wind and water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Shingle soil is in capability subclass VIe, nonirrigated, and the Taluce soil is in capability subclass VIIs, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Taluce soil is in the Shallow Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

266—Shingle-Theedle complex, 45 to 75 percent slopes. This map unit is on hills. Areas are irregular in shape and are 50 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Shingle clay 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 Kishona loam, Samday clay loam, Taluce sandy loam, Gayhart clay loam, and rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Shingle soil is shallow and well drained. It formed in colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Theedle soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 2 inches thick. The underlying material is light yellowish brown loam about 27 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Theedle soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness. The Theedle soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Theedle soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

267—Shingle-Theedle loams, moist, 45 to 75 percent slopes. This map unit is on hills and ridges. It generally occurs on north-facing slopes. Areas are irregular in shape and are 20 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Shingle 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 Kishona loam, Samday clay loam, Taluce sandy loam, Gayhart clay loam, and rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Shingle soil is shallow and well drained. It formed in colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 4 inches thick. The underlying material is yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Theedle soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded sedimentary rock. Typically, the surface layer is grayish brown loam about 4 inches thick. The underlying material is yellowish brown loam about 26 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Theedle soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver

sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness. The Theedle soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Theedle soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

268—Shingle-Theedle-Kishona association, 6 to 25 percent slopes. This map unit is on dissected hills. Deep gullies and draws are common. Areas are irregular in shape and are 50 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent Shingle clay loam, 6 to 25 percent slopes, on hillcrests and in areas adjacent to rock outcrops; 30 percent Theedle fine sandy loam, 6 to 15 percent slopes, on the upper part of hillslopes; and 20 percent Kishona fine sandy loam, 6 to 15 percent slopes, on the lower part of hillslopes.

Included in this unit are small areas of Samday clay loam, Worf loam, Cushman loam, and rock outcrop. 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 colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is low. The 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 Theedle soil is moderately deep and well drained. It formed in colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is light brownish gray fine sandy loam about 1 inch thick. The underlying material is pale yellow loam about 37 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 Kishona soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown fine sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is pale yellow loam and clay loam.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Theedle and Kishona soils is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness. The Theedle and Kishona soils have few limitations affecting plants that are suitable for livestock grazing.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope, droughtiness in the Shingle soil, and the hazard of water erosion on all of the soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Shingle soil is in capability subclass VIe, nonirrigated, and the Theedle and Kishona soils are in capability subclass IVe, nonirrigated. The Shingle soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Theedle and Kishona soils are in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

269—Shingle-Theedle-Kishona association, moist, 3 to 30 percent slopes. This map unit is on dissected hills (fig. 5). Areas are irregular in shape and are 25 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Shingle clay loam, 9 to 30 percent slopes, on ridges; 30 percent Theedle loam, 9 to 15 percent slopes, on the upper part of hillslopes; and 20 percent Kishona loam, 3 to 10 percent slopes, on the lower part of hillslopes.

Included in this unit are small areas of rock outcrop, Samday clay loam, and Cushman loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Shingle soil is shallow and well drained. It formed in colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is pale brown clay loam about 2 inches thick. The underlying material is yellowish brown clay loam about 14 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Theedle soil is moderately deep and well drained. It formed in colluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is dark yellowish brown loam about 2 inches thick. The underlying material is brown and pale brown loam about 20 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 Kishona soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is grayish brown loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown loam and clay loam.

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

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Theedle and Kishona soils is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness. The Theedle and Kishona soils have few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland

seeding is poor. The main limitations affecting seeding are the slope, droughtiness in the Shingle soil, and the hazard of water erosion in all of the soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Shingle soil is in capability subclass VIIe, nonirrigated, and the Theedle and Kishona soils are in capability subclass IVe, nonirrigated. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Theedle and Kishona soils are in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

270—Shingle-Theedle-Rock outcrop association, moist, 15 to 45 percent slopes. This map unit is on hills. Areas are generally elongated and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs with a few coniferous trees. The canopy cover is 10 to 20 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent Shingle fine sandy loam, 25 to 45 percent slopes, on hillslopes and hillcrests that are associated with the areas of Rock outcrop; 30 percent Theedle loam, 15 to 40 percent slopes, on the lower part of hillslopes; and 20 percent areas of Rock outcrop.

Included in this unit are small areas of Kishona loam, Taluce sandy loam, and Tullock sandy loam. 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 and colluvium derived from interbedded shale and sandstone. Typically, the surface layer is brown fine sandy loam about 2 inches thick. The underlying material is very pale brown loam about 8 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

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

The Theedle soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded shale and sandstone. Typically, the surface layer is light brownish gray loam about 5 inches thick. The underlying material is pale brown clay loam and loam about 31 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is clay loam.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 areas of Rock outcrop consist of exposures of interbedded shale, siltstone, sandstone, and small areas of porcellanite.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Shingle soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Theedle soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass with a few coniferous trees. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Shingle soil is limited by droughtiness and the rooting depth. The Theedle soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Shingle soil is in capability subclass VIIe, nonirrigated; the Theedle soil is in capability subclass VIe, nonirrigated; and the areas of Rock outcrop are in

capability class VIII. The Shingle soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Theedle soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

271—Shingle-Wibaux complex, 0 to 60 percent slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 1,000 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle fine sandy loam and 30 percent Wibaux channery 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, Shingle Variant loam, and rock outcrop. Included areas make up about 20 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 and colluvium derived from shale. Typically, the surface layer is yellowish brown fine sandy loam about 1 inch thick. The underlying material is light yellowish brown loam about 17 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

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

The Wibaux soil is very deep and somewhat excessively drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is light reddish brown channery loam about 5 inches thick. The upper 7 inches of the underlying material is reddish brown very channery loam. The lower part to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Wibaux soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

272—Shingle-Wibaux complex, cool, 15 to 80 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses, shrubs, and coniferous trees. The canopy cover is 25 to 60 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 55 percent Shingle silt loam, 15 to 80 percent slopes, and 25 percent Wibaux channery loam, 20 to 75 percent 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 Theedle loam and rock outcrops of shale, sandstone, and porcellanite. Included areas make up about 20 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 and colluvium derived from shale. Typically, the surface is covered with a mat of undecomposed pine needles about 1 inch thick. The surface layer is very pale brown silt loam about 2

inches thick. The underlying material is very pale brown silt loam about 11 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Wibaux soil is very deep and somewhat excessively drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is light reddish brown channery loam about 3 inches thick. The upper 15 inches of the underlying material is reddish brown very channery loam. The lower part to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Wibaux soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The plant community on this unit is mainly an overstory of ponderosa pine and Rocky Mountain juniper with an understory of needleandthread, bluebunch wheatgrass, little bluestem, and western wheatgrass.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the more accessible areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation is the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is a woodland site.

273—Shingle-Worf complex, 6 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle clay loam and 35 percent Worf 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 rock outcrop, Samday clay loam, Cushman loam, Theedle loam, and Shingle Variant loam. 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 interbedded sedimentary rock. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 13 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Worf soil is shallow and well drained. It formed in residuum derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 2 inches thick. The upper part of the subsoil is yellowish brown clay loam about 5 inches thick. The lower part is yellowish brown loam about 8 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Worf soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases;

therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass VIe, nonirrigated, and is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

274—Shingle-Worf complex, moist, 9 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Shingle clay loam and 25 percent Worf 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 rock outcrop, Samday clay loam, Cushman loam, Theedle loam, and Shingle Variant loam. Included areas make up about 25 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 interbedded sedimentary rock. Typically, the surface layer is yellowish brown clay loam about 3 inches thick. The underlying material is yellowish brown clay loam about 14 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Worf soil is shallow and well drained. It formed in residuum derived from interbedded sedimentary rocks. Typically, the surface layer is brown loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 9 inches thick. The lower part is very pale brown loam about 3 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Worf soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass VIe, nonirrigated, and is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

275—Sinkson silt loam, 6 to 15 percent slopes. This very deep, well drained soil is on alluvial fans and toe slopes. It formed in alluvium derived from shale. Areas are irregular in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 4,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

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

Typically, the surface layer is reddish brown silt loam about 3 inches thick. The subsoil to a depth of 60 inches or more is reddish brown, light reddish brown, and light red silt loam.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the short growing season and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is Idaho fescue, green needlegrass, needleandthread, western wheatgrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

276—Spearman-Wibaux association, 6 to 25 percent slopes. This map unit is on uplands characterized by long hillslopes broken by numerous ridges. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Spearman loam, 6 to 15 percent slopes, on hillslopes and 30 percent Wibaux channery loam, 6 to 25 percent slopes, on ridges.

Included in this unit are small areas of porcellanite outcrop, Harlan loam, and Kirtley loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Spearman soil is very deep and well drained. It formed in residuum and alluvium derived from porcellanite. Typically, the surface layer is reddish brown loam about 2 inches thick. The upper part of the subsoil is reddish brown clay loam about 8 inches thick. The lower 11 inches is reddish brown loam. The substratum to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 20 to 40 inches.

Permeability in the Spearman soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Wibaux soil is very deep and somewhat excessively drained. It formed in residuum and colluvium derived from porcellanite. Typically, the surface layer is light reddish brown channery loam about 5 inches thick. The upper 7 inches of the underlying material is reddish brown very channery loam. The lower part to a depth of 60 inches or more is fractured, displaced porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Wibaux soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Spearman soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The potential plant community on the Wibaux soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is fair on the Spearman soil and poor on the Wibaux soil. The main limitations affecting seeding on the Wibaux soil are droughtiness, the rock fragments on the surface, and the hazard of water erosion. The main management concern affecting seeding on the Spearman soil is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Spearman soil is in capability subclass IVe, nonirrigated, and the Wibaux soil is in capability subclass VIIs, nonirrigated. The Spearman soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Wibaux soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

277—Taluce-Tullock-Rock outcrop association, 3 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and elongated and are 10 to 150 acres in size. The native vegetation is mainly grasses, shrubs, and coniferous trees. The canopy cover ranges from 15 to 40 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Taluce sandy loam on hillcrests, 25 percent Tullock loamy sand on hillslopes below the areas of Rock outcrop, and 25 percent areas of sandstone Rock outcrop.

Included in this unit are small areas of Bowbac fine sandy loam and Vonalee 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 somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick. The underlying material is pale brown sandy loam about 17 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderately rapid in the Taluce soil. Available water capacity is very low. The 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.

The Tullock soil is moderately deep and excessively drained. It formed in residuum and alluvium derived from sandstone. Typically, the surface layer is brown loamy sand about 3 inches thick. The underlying material is yellowish brown and light gray loamy fine sand and loamy sand about 31 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is rapid in the Tullock soil. Available water capacity is very low. The 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 severe.

The areas of Rock outcrop consist of exposed sandstone on benches and escarpments. The benches generally are 200 to 300 feet wide, and the escarpments are 5 to 50 feet high.

This unit is used for livestock grazing and wildlife habitat.

The plant community on this unit is mainly ponderosa pine and Rocky Mountain juniper with an understory of needleandthread, bluebunch wheatgrass, little bluestem, and western wheatgrass.

The production of vegetation suitable for livestock grazing is limited by droughtiness. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the areas of Rock outcrop, the presence of trees on the soils, and droughtiness in the soils.

The Taluce soil is in capability subclass VIIs, nonirrigated; the Tullock soil is in capability subclass VIe, nonirrigated; and the areas of Rock outcrop are in capability class VIII. The Taluce and Tullock soils are a woodland site.

278—Taluce-Tullock-Vonalee association, 6 to 15 percent slopes. This map unit is on hills. Areas are irregular in shape and are 10 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Taluce fine sandy loam on hillcrests; 30 percent Tullock fine sandy loam on hillcrests and the upper part of hillslopes; and 25 percent Vonalee loamy sand on the lower part of hillslopes.

Included in this unit are small areas of Bowbac fine sandy loam, Hiland sandy loam, and sandstone outcrop on hillslopes and hillcrests. 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 somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the surface layer is pale brown fine sandy loam about 4 inches thick. The underlying material is yellowish brown sandy loam about 13 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderately rapid in the Taluce soil. Available water capacity is very low. The 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.

The Tullock soil is moderately deep and excessively drained. It formed in alluvium and residuum derived from sandstone. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The underlying material is light yellowish brown loamy sand and loamy fine sand about 23 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is rapid in the Tullock soil. Available water capacity is very low. The 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 severe.

The Vonalee soil is very deep and somewhat excessively drained. It formed in alluvium derived from sandstone. Typically, the surface layer is dark brown loamy sand about 2 inches thick. The upper 12 inches of the subsoil is dark yellowish brown sandy loam. The next 20 inches is yellowish brown sandy loam. The lower part to a depth of 60 inches or more is light yellowish brown sandy loam.

Permeability is moderately rapid in the Vonalee soil. Available water capacity is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Taluce soil is mainly needleandthread, prairie sandreed, and little bluestem. 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. As the ecological condition deteriorates, threadleaf sedge, yucca, and fringed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

The potential plant community on the Tullock and Vonalee soils is mainly needleandthread, prairie sandreed, and Indian ricegrass. 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. As the ecological condition deteriorates, fringed sagewort, blue grama, yucca, and cudweed sagewort increase. As the ecological condition further deteriorates, broom snakeweed and cheatgrass invade.

The production of vegetation suitable for livestock grazing on the Taluce and Tullock soils is limited by droughtiness. The Vonalee soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is poor on the Taluce and Tullock soils and fair on the Vonalee soil. The main limitations affecting seeding are droughtiness in the Taluce soil and the hazards of wind and water erosion on all of the soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Taluce soil is in capability subclass VIIs, nonirrigated; the Tullock soil is in capability subclass VIe, nonirrigated; and the Vonalee soil is in capability subclass IVe, nonirrigated. The Taluce soil is in the Shallow Sandy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Tullock and Vonalee soils are in the Sandy, 10- to 14-inch precipitation zone, Northern Plains range site.

279—Taluce-Tullock-Vonalee association, moist, 9 to 30 percent slopes. This map unit is on hills and ridges. Areas are irregular in shape and are 10 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Taluce fine sandy loam on hillcrests and ridges, 30 percent Tullock loamy fine sand on ridges, hillcrests, and the upper part of hillslopes, and 25 percent Vonalee fine sandy loam on the lower part of hillslopes.

Included in this unit are small areas of Bowbac fine sandy loam and Hiland sandy loam on hillslopes and sandstone outcrops on ridges. 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 somewhat excessively drained. It formed in residuum and colluvium derived from sandstone. Typically, the surface layer is dark brown fine sandy loam about 1 inch thick. The underlying material is pale brown fine sandy loam about 17 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

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

The Tullock soil is moderately deep and excessively drained. It formed in residuum and colluvium derived from sandstone. Typically, the surface layer is brown loamy fine sand about 4 inches thick. The underlying material is yellowish brown and light gray loamy fine sand about 30 inches thick over soft sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is rapid in the Tullock soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Vonalee soil is very deep and somewhat excessively drained. It formed in alluvium derived from sandstone. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The upper part of the subsoil is yellowish brown fine sandy loam about 10 inches thick. The lower part to a depth of 60 inches or more is pale brown sandy loam.

Permeability is moderately rapid in the Vonalee soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Taluce soil is mainly prairie sandreed, needleandthread, western wheatgrass, and bluebunch wheatgrass. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and annuals invade.

The potential plant community on the Tullock and Vonalee soils is mainly sand bluestem, prairie sandreed, needleandthread, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Taluce and Tullock soils is limited by droughtiness. The Vonalee soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is poor on the Taluce and Tullock soils and fair on the Vonalee soil. The main limitations affecting seeding are droughtiness in the Taluce soil and the hazards of wind and water erosion on all of the soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

The Taluce soil is in capability subclass VIIe, nonirrigated, and the Tullock and Vonalee soils are in capability subclass VIe, nonirrigated. The Taluce soil is in the Shallow Sandy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Tullock and Vonalee soils are in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

280—Taluce Variant-Treoff-Theedle Variant association, 10 to 65 percent slopes. This map unit is on ridges and hills. Areas are irregular in shape and

are 10 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Taluce Variant sandy loam, 10 to 65 percent slopes, on crests and back slopes; 25 percent Treoff fine sandy loam, 10 to 65 percent slopes, on crests and back slopes; and 20 percent Theedle Variant very fine sandy loam, 25 to 65 percent slopes, on hillslopes.

Included in this unit are small areas of Shingle loam, sandstone outcrop, and Bauxson soils. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Taluce Variant soil is shallow and somewhat excessively drained. It formed in residuum and colluvium derived from arkosic sandstone. Typically, the surface layer is grayish brown sandy loam about 11 inches thick. The underlying material is light yellowish brown sand about 8 inches thick over soft sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is rapid in the Taluce Variant soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Treoff soil is shallow and somewhat excessively drained. It formed in residuum and colluvium derived from interbedded shale and arkosic sandstone. Typically, the surface layer is brown fine sandy loam about 1 inch thick. The upper 8 inches of the subsoil is dark brown fine sandy loam. The lower part is pale brown fine sandy loam about 10 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

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

The Theedle Variant soil is moderately deep and somewhat excessively drained. It formed in residuum and colluvium derived from interbedded shale and arkosic sandstone. Typically, the surface layer is grayish brown very fine sandy loam about 9 inches thick. The subsoil is pale brown very fine sandy loam about 18 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam or silt loam.

Permeability is moderately rapid in the Theedle Variant soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

Most areas of this unit are used for livestock grazing and wildlife habitat.

The potential plant community on the Taluce Variant and Treoff soils is mainly prairie sandreed, needleandthread, western wheatgrass, and bluebunch wheatgrass. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and annuals invade.

The potential plant community on the Theedle Variant soil is mainly prairie sandreed, sand bluestem, needleandthread, Indian ricegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years, 3,000 pounds in favorable years, and 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, yucca, and unpalatable forbs increase. As the ecological condition further deteriorates, red threeawn, thistle, and locoweed invade.

The production of vegetation suitable for livestock grazing on the Taluce Variant and Treoff soils is limited by droughtiness. The Theedle Variant soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

This map unit is in capability subclass VIIe, nonirrigated. The Taluce Variant and Treoff soils are in the Shallow Sandy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Theedle Variant soil is in the Sandy, 15- to 19-inch precipitation zone, Northern Plains range site.

281—Theedle-Kishona association, 6 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Theedle loam on the upper part of hillslopes and 30 percent Kishona loam on the lower part of hillslopes and on alluvial fans.

Included in this unit are small areas of Shingle clay 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 alluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The underlying material is very pale brown loam about 28 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

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

The Kishona soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown loam about 5 inches thick. The subsoil to a depth of 60 inches or more is very pale brown silty clay loam and loam.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Theedle soil and the hazard of water erosion and the low annual precipitation in both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

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

282—Theedle-Kishona association, moist, 6 to 9 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Theedle fine sandy loam on the upper part of hillslopes and 35 percent Kishona loam on the lower part of hillslopes and on alluvial fans.

Included in this unit are small areas of Zigweid loam and Forkwood fine sandy 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 alluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown fine sandy loam about 3 inches thick. The underlying material is pale yellow clay loam about 22 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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 Kishona soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is light yellowish brown loam about 2 inches thick. The subsoil to a depth of 60 inches or more is light yellowish brown loam and clay loam.

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

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Theedle soil and the hazard of water erosion in both soils. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

283—Theedle-Kishona association, moist, 9 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 45 percent Theedle clay loam on the upper part of hillslopes and 35 percent Kishona loam on the lower part of hillslopes and on alluvial fans.

Included in this unit are small areas of Zigweid loam, Cambria loam, and Shingle clay 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 alluvium and residuum derived from interbedded sedimentary rock. Typically, the surface layer is pale brown clay loam about 2 inches thick. The underlying material is brownish yellow clay loam and loam about 30 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Theedle soil. Available water capacity also is moderate. The 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.

The Kishona soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 2 inches thick. The subsoil to a depth of 60 inches or more is pale brown loam.

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

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are droughtiness in the Theedle soil and the hazard of water erosion in both soils. Maintaining crop residue on or near the surface helps to control runoff

and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. The main management concern is the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IVe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

284—Tolman-Beeno-Beenom complex, 5 to 45 percent slopes. This map unit is on mountain dip slopes. Areas are irregular in shape and are 50 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 41 to 43 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Tolman channery loam, 25 percent Beeno silt loam, and 20 percent Beenom 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 Abac silt loam, Peritsa silt loam, and Trimad gravelly loam. Also included are small areas of deep very channery soils and reddish loamy and clayey soils derived from the Chugwater and Amsden formations. Included areas make up about 15 percent of the total acreage. Percentages vary from one area to another.

The Tolman soil is shallow and well drained. It formed in residuum and colluvium derived from interbedded limestone and sandstone. Typically, the surface layer is dark grayish brown channery loam about 5 inches thick. The upper part of the subsoil is dark grayish brown very channery clay loam about 6 inches thick. The lower part is brown very channery clay loam about 4 inches thick over cherty limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Tolman soil. Available water capacity is very low. The 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 Beeno soil is moderately deep and well drained. It formed in residuum and colluvium derived from interbedded shale and sandstone. Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The upper part of the subsoil is dark brown gravelly silty clay loam about 7 inches thick. The next 7 inches is brown gravelly silty clay loam. The underlying material is light yellowish brown gravelly silty clay loam about 8 inches thick over soft interbedded shale and sandstone. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Beeno soil. Available water capacity is low. The 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 Beenom soil is shallow and well drained. It formed in residuum derived from limestone and sandstone. Typically, the surface layer is dark grayish brown loam about 3 inches thick. The upper part of the subsoil is very dark brown clay loam about 6 inches thick. The lower part is yellowish brown gravelly clay loam about 9 inches thick over hard limestone. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Beenom soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Tolman soil is mainly Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Beeno soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Beenom soil is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The production of vegetation suitable for livestock grazing on the Tolman and Beenom soils is limited by droughtiness and the rooting depth. The Beeno soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Tolman soil is in capability subclass VIIs, nonirrigated, and the Beeno and Beenom soils are in capability subclass VIe, nonirrigated. The Tolman soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site; the Beeno soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site; and the Beenom soil is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

285—Trimad-Doney-Wayden complex, 15 to 45 percent slopes. This map unit is on terrace escarpments and hillslopes. Areas are irregular in shape and are 50 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 30 percent Trimad gravelly loam, 25 percent Doney loam, and 25 percent Wayden 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 Windham gravelly loam, Reget silty clay loam, and Savar clay loam. Also included are small areas of shale outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Trimad soil is very deep and well drained. It formed in colluvium derived from sedimentary rock. Typically, the surface layer is dark brown gravelly loam about 8 inches thick. The subsoil is very pale brown very gravelly loam 22 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loam.

Permeability is moderate in the Trimad soil. Available water capacity also is moderate. The 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 Doney soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is brown loam about 3 inches thick. The upper 10 inches of the subsoil is pale brown silty clay loam. The lower part is very pale brown clay loam about 11 inches thick over soft shale. Depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Doney soil. Available water capacity is low. The 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 Wayden soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown clay loam about 2 inches thick. The subsoil is light olive brown silty clay about 10 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Wayden soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Trimad soil is mainly Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Doney soil is mainly Idaho fescue, spike fescue, western wheatgrass, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The potential plant community on the Wayden soil is mainly western wheatgrass, little bluestem, green needlegrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Trimad and Wayden soils is limited by droughtiness. The Doney soil has few limitations affecting plants that are suitable for livestock grazing. The slope limits access by livestock and results in overgrazing in the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. The main limitation affecting seeding is the slope.

The Trimad and Doney soils are in capability subclass VIe, nonirrigated, and the Wayden soil is in capability subclass VIIe, nonirrigated. The Trimad soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site; the Doney soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site; and the Wayden soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

286—Trimad-Trivar complex, 0 to 25 percent slopes. This map unit is on terraces, toe slopes, and alluvial fans. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,400 to 6,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 45 percent Trimad gravelly loam and 35 percent Trivar silt 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 rock outcrop, Abac silt loam, Peritsa silt loam, and Savage silt loam, gravelly substratum. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Trimad soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown gravelly loam about 8 inches thick. The upper 24 inches of the subsoil is very pale brown very gravelly loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly loam and extremely gravelly loam. In some areas 10 to 30 percent of the surface is covered with stones, cobbles, and boulders.

Permeability is moderate in the Trimad soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Trivar soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown silt loam about 2 inches thick. The upper part of the subsoil is dark brown silt loam about 5 inches thick. The next 13 inches is pinkish white silt loam. The lower part to a depth of 60 inches or more is pink and reddish yellow gravelly sandy loam.

Permeability is moderate in the Trivar soil. Available water capacity also is moderate. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Trimad soil is Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. The potential plant community produces about 950 pounds of air-dry vegetation per acre in normal years. Production varies from 1,100 pounds in favorable years to 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Trivar soil is Idaho fescue, green needlegrass, western wheatgrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Trimad soil is limited by droughtiness. The Trivar soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the gravel in the surface layer of the Trimad soil and the hazard of water erosion on both soils. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIe, nonirrigated. The Trimad soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Trivar soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

287—Trimad-Twin Creek association, 0 to 6 percent slopes. This map unit is on terraces. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 5,400 to 5,600 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 40 percent Trimad gravelly loam on the edge of terraces and on knolls in the center of terraces and 40 percent Twin Creek silt loam in the center of terraces.

Included in this unit are small areas of a soil that is similar to the Twin Creek soil but has a reddish gravelly loam substratum. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Trimad soil is very deep and well drained. It formed in alluvium derived from limestone, shale, and granite. Typically, the surface layer is brown and dark brown gravelly loam about 8 inches thick. The upper 9 inches of the subsoil is brown very gravelly loam. The lower part is pale brown and very pale brown very gravelly loam about 15 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is moderate in the Trimad soil. Available water capacity also is moderate. The 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 Twin Creek soil is very deep and well drained. It formed in alluvium derived from shale. Typically, the surface layer is dark reddish brown silt loam about 8 inches thick. The upper 6 inches of the subsoil is dark red silty clay loam. The next 9 inches is yellowish red silty clay loam. The next part to a depth of 46 inches is light reddish brown silt loam. The lower part to a depth of 60 inches or more is reddish brown very gravelly silt loam.

Permeability is moderate in the Twin Creek soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Trimad soil is Columbia needlegrass, Idaho fescue, western wheatgrass, and spike fescue. The potential plant community produces about 950 pounds of air-dry vegetation in normal years. It produces about 1,100

pounds in favorable years and 600 pounds in unfavorable years. As the ecological condition deteriorates, threetip sagebrush, big sagebrush, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The potential plant community on the Twin Creek soil is Idaho fescue, western wheatgrass, green needlegrass, and spike fescue. The potential plant community produces about 2,200 pounds of air-dry vegetation in normal years. It produces about 3,000 pounds in favorable years and 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Trimad soil is limited by droughtiness. The Twin Creek soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability for rangeland seeding is fair on the Trimad soil and good on the Twin Creek soil. The main limitation affecting seeding on the Trimad soil is the gravelly surface layer.

The Trimad soil is in capability subclass VIs, nonirrigated, and the Twin Creek soil is in capability subclass IVe, nonirrigated. The Trimad soil is in the Coarse Upland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Twin Creek soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

288—Twin Creek loam, 0 to 6 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from sandstone and shale. Areas are deltaic and irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of soils that are similar to the Twin Creek soil but have a thicker surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is reddish brown loam about 10 inches thick. The upper part of the subsoil is reddish brown loam about 9 inches thick. The lower part to a depth of 60 inches or more is reddish brown and reddish yellow loam.

Permeability is moderate in the Twin Creek soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the short growing season. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is Idaho fescue, spike fescue, western wheatgrass, and green needlegrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is good.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

289—Twin Creek Variant silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on alluvial fans and small bottoms in the valleys. It formed in alluvium derived from sandstone and shale. Areas are elongated and irregular in shape and are 25 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,000 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Twin Creek silt loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dusky red silt loam about 10 inches thick. The subsoil is red silt loam about 32 inches thick. The substratum to a depth of 60 inches or more is light red silt loam.

Permeability is moderate in the Twin Creek Variant soil. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 18 to 36 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating water table is at a depth of 1.5 to 3.0 feet from April through November. It is the result of the irrigation of this soil and the adjacent soils. This soil is subject to rare flooding.

This unit is used for irrigated grass hay and pasture, livestock grazing, and wildlife habitat.

This soil is well suited to irrigated hay and pasture. Irrigation water needs to be applied carefully to prevent the buildup of the water table.

The potential plant community on this unit is mainly Nebraska sedge, slender wheatgrass, tufted hairgrass, and spike sedge. The potential plant community produces about 5,000 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 3,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge and woody plants increase. As the ecological condition further deteriorates, Kentucky bluegrass, smooth brome, Canada thistle, foxtail barley, and timothy invade.

The production of vegetation suitable for livestock grazing is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of this unit for rangeland seeding is fair. The main limitation is the wetness. Plants that tolerate wetness should be selected for planting.

This map unit is in capability subclass IVw, irrigated and nonirrigated, and is in the Subirrigated, 15- to 19-inch precipitation zone, Northern Plains range site.

290—Ulm clay loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wyarno clay loam and Bidman loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is grayish brown clay loam about 4 inches thick. The upper part of the subsoil is grayish brown clay about 8 inches thick. The lower part to a depth of 60 inches or more is light brownish gray clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

291—Ulm clay loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is about 110 to 120 days.

Included in this unit are small areas of Wyarno clay loam and Bidman loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown clay loam about 8 inches thick. The upper part of the subsoil is pale brown clay about 7 inches thick. The lower part to a depth of 60 inches or more is very pale brown clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

292—Ulm clay loam, dry, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are irregular in shape and are 10 to 120 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wyarno clay loam and Bidman loam. Also included are small areas of a soil that is similar to the Ulm soil but has sandy clay loam, loamy sand, or sandy loam in the lower part of the subsoil. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 2 inches thick. The upper 20 inches of the subsoil is pale brown clay loam. The lower part to a depth of 60 inches or more is very pale brown clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer and the low annual precipitation. If this unit is used for irrigated crops, the main limitations are the slow permeability and the clay loam surface layer. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. Grain and grasses respond to nitrogen. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Legumes respond to phosphorus, boron, and sulfur. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

293—Ulm clay loam, dry, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Wyarno clay loam and Bidman loam. Also included in some areas are small areas of a soil that is similar to the Ulm soil but has sandy clay loam, sandy loam, or loamy sand in the lower part of the subsoil. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown clay loam about 9 inches thick. The upper 13 inches of the subsoil is yellowish brown clay. The next 10 inches is

grayish brown clay loam. The lower part to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Ulm soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer and the low annual precipitation. If this unit is used for irrigated crops, the main limitations are the slow permeability and the clay loam surface layer. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

294—Urban land-Kishona, moist-Clarkelen complex, 0 to 3 percent slopes. This map unit is on flood plains, alluvial fans, and terraces. Areas are elongated and are 50 to 100 acres in size. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent areas of Urban land, 25 percent Kishona loam, and 15 percent Clarkelen fine sandy loam. The areas of Urban land are intermingled throughout the unit, the Kishona soil is on alluvial fans and terraces, and the Clarkelen soil is on flood plains. 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 Havertel silt loam, Haverdad fine sandy loam, Recluse loam, Nuncho clay loam, and areas where the soil has been removed or filled. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The areas of Urban land consist of land covered by streets, buildings, and other structures.

The Kishona soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. The surface layer is grayish brown loam about 4 inches thick. The subsoil to a depth of 60 inches or more is very pale brown loam and clay loam.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 Clarkelen soil is very deep and somewhat excessively drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is grayish brown fine sandy loam about 3 inches thick. The upper 30 inches of the underlying material is brown fine sandy loam stratified with thin layers of brown and dark brown loam. The lower part to a depth of 60 inches or more is dark yellowish brown sand. In some areas the surface layer is loam.

Permeability is moderately rapid in the Clarkelen soil. Available water capacity is moderate. The 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. Most of this soil is somewhat protected from flooding by water control structures, but it is subject to rare flooding. A fluctuating water table is at a depth of 4 to 6 feet from March through May.

This unit is used for urban development.

If this unit is used for urban development, the main management concerns on the Clarkelen soil and the areas of Urban land on flood plains are the hazard of flooding and the seasonal high water table. The moderate shrink-swell potential of the Kishona soil is also a limitation affecting urban development. Topsoil can be stockpiled and used to reclaim areas that are disturbed during construction. The selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and an irrigation system are needed to establish lawn grasses and other small seeded plants.

This unit is well suited to most garden crops. It has few limitations. It is limited mainly by low fertility. The application of mulch improves the fertility of gardens. Grasses respond to nitrogen. Vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is well suited to environmental plantings. Among the trees that are suitable for planting are Siberian elm, green ash, honeylocust, Russian-olive, Siberian crabapple, Rocky Mountain juniper, eastern redcedar, and ponderosa pine. Among the shrubs that are suitable for planting are skunkbush sumac, common chokecherry, silver buffaloberry, lilac, Tatarian honeysuckle, and Siberian peashrub.

No capability class and range site are assigned to the areas of Urban land in this map unit. The Kishona and Clarkelen soils are in capability subclass IIIe, nonirrigated.

295—Urban land-Platsher-Wolfvar complex, 0 to 6 percent slopes. This map unit is on outwash terraces. Areas are irregular in shape and are 100 to 500 acres in size. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent areas of Urban land, 30 percent Platsher clay loam, and 20 percent Wolfvar 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 Nuncho clay loam, Platsher Variant loam, Wolf loam, Recluse loam, and areas where the soil has been removed or filled. Sporadic areas in this unit are somewhat poorly drained with a high water table because of water moving laterally through the underlying gravel. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The areas of Urban land consist of land covered by streets, buildings, parking lots, and other structures.

The Platsher soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is very dark grayish brown clay loam about 6 inches thick. The upper part of the subsoil is dark brown clay about 10 inches thick. The next 12 inches is yellowish brown clay loam. The lower part to a depth of 60 inches or more is grayish brown gravelly loam. Depth to the gravelly layer ranges from 20 to 40 inches.

Permeability is slow in the Platsher soil. Available water capacity is high. The 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 Wolfvar soil is very deep and well drained. It formed in alluvium derived from sedimentary rock over outwash deposits. Typically, the surface layer is dark brown clay loam about 5 inches thick. The upper part of the subsoil is dark brown clay loam about 10 inches thick. The next 7 inches is light gray gravelly loam. The lower part to a depth of 60 inches or more is white extremely gravelly loamy sand. Depth to the extremely gravelly layer is 20 to 40 inches. In some areas the surface layer is loam.

Permeability is slow in the Wolfvar soil. Available water capacity is moderate. The 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 urban development.

This unit is moderately well suited to urban development. The main limitation is the shrink-swell potential. The high water table in some of the included soils is also a limitation. Topsoil can be stockpiled and used to reclaim areas that are disturbed during construction. The selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and an irrigation system are needed to establish lawn grasses and other small seeded plants.

This unit is well suited to most garden crops. It has few limitations. It is limited mainly by low fertility. The application of mulch improves the fertility of gardens. Grasses respond to nitrogen. Vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is well suited to environmental plantings. Among the trees that are suitable for planting are Siberian elm, green ash, honeylocust, Russian-olive, Siberian crabapple, Rocky Mountain juniper, ponderosa pine, and eastern redcedar. Among the shrubs that are suitable for planting are skunkbush sumac, common chokecherry, silver buffaloberry, lilac, Tatarian honeysuckle, Nanking cherry, and Siberian peashrub.

No capability class and range site are assigned to the areas of Urban land in this map unit. The Platsher and Wolfvar soils are in capability subclass IIIe, nonirrigated.

296—Urban land-Wyarno-Nuncho complex, 0 to 3 percent slopes. This map unit is on alluvial fans and terraces. Areas are elongated and are 50 to 150 acres in size. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent areas of Urban land, 35 percent Wyarno clay loam, and 15 percent Nuncho 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 Platsher clay loam, Recluse loam, Zigweid loam, and areas where the soil has been removed or filled. Also included are areas of similar soils that have strata of very gravelly sand within a depth of 30 to 60 inches and low-lying areas that are generally protected from flooding by major water control structures but are subject to rare flooding and fluctuating water tables. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The areas of Urban land consist of land covered by streets, buildings, parking lots, and other structures.

The Wyarno soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown clay loam about 3 inches thick. The upper part of the subsoil is brown clay loam and clay about 12 inches thick. The lower part to a depth of 60 inches or more is pale brown clay loam.

Permeability is slow in the Wyarno soil. Available water capacity is high. The 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 Nuncho soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark brown clay loam about 10 inches thick. The upper part of the subsoil is brown clay loam and clay about 25 inches thick. The lower part to a depth of 60 inches or more is brown clay loam and loam. In some areas the surface layer is sandy clay loam.

Permeability is slow in the Nuncho soil. Available water capacity is high. The 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 urban development.

If this unit is used for urban development, the main limitation is shrink-swell potential. The hazard of flooding and the wetness are the main management concerns affecting urban development in areas of Urban land on flood plains. Topsoil can be stockpiled and used to reclaim areas that are disturbed during construction. The selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and an irrigation system are needed to establish lawn grasses and other small seeded plants.

This unit is well suited to most garden crops. It has few limitations. It is limited mainly by low fertility. The application of mulch improves the fertility of gardens. Grasses respond to nitrogen. Vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is well suited to environmental plantings. Among the trees that are suitable for planting are Siberian elm, green ash, honeylocust, Russian-olive, Siberian crabapple, Rocky Mountain juniper, ponderosa pine, and eastern redcedar. Among the shrubs that are suitable for planting are skunkbush sumac, common chokecherry, silver buffaloberry, lilac, Tatarian honeysuckle, Nanking cherry, and Siberian peashrub.

No capability class and range site are assigned to the areas of Urban land in this map unit. The Wyarno and Nuncho soils are in capability subclass IIIe, nonirrigated.

297—Ustic Torriorthents-Pits complex, 0 to 100 percent slopes. This map unit is on mine sites that include mine dumps, spoil piles, and mine pits. It also includes those undisturbed areas interspersed between the pits, dumps, and spoil piles. These areas occur on a variety of landforms and are continuously changing because of active mining operations. Areas are irregular in shape and are 25 to 500 acres in size. The native vegetation has been removed but was mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 17 inches, the average annual temperature is 45 to 47

degrees F, and the average frost-free period is 110 to 120 days.

The percentage of these components varies constantly because of mining operations. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Ustic Torriorthents are very deep and well drained. These soils formed in a variety of materials derived mainly from interbedded sedimentary rock. Commonly, the surface layer is light gray loam about 2 inches thick. Commonly, the underlying material to a depth of 60 inches or more is stratified light brownish gray, yellow, and dark brown loam and clay loam. These soils vary considerably within short distances.

Permeability is commonly moderate but is highly variable in the Ustic Torriorthents. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

Pits are in areas of active mining.

Because the soil materials vary considerably, onsite investigation is needed to make reliable interpretations in these areas.

Onsite investigations are also needed to determine the appropriate measures required for reclamation.

298—Wayden silty clay, 0 to 35 percent slopes. This shallow, well drained soil is on hills. It formed in residuum and colluvium derived from shale. Areas are irregular in shape and are 25 to 150 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Doney loam, Norbert clay, Reget clay loam, and Savage silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray silty clay about 2 inches thick. The subsoil is light brownish gray silty clay about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Wayden soil. Available water capacity is very low. The 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 mainly for livestock grazing and wildlife habitat.

The potential plant community on this unit is western wheatgrass, spike fescue, little bluestem, and green needlegrass. The potential plant community produces about 1,400 pounds of air-dry vegetation per acre in normal years, 1,800 pounds in favorable years, and 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness and the rooting depth. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are the slope, droughtiness, and the hazard of water erosion.

This map unit is in capability subclass VIe, nonirrigated, and is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

299—Wetterdon-Recluse complex, 0 to 9 percent slopes. This map unit is on alluvial fans and hillslopes. Areas are elongated along drainageways and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 40 percent Wetterdon silt loam and 35 percent Recluse 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 Cedak loam, Emigrant clay loam, and Platmak loam. Also included in some areas are soils that are dark gray to a depth of 20 inches or more and that have a clay subsoil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Wetterdon soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark gray silt loam about 5 inches thick. The upper 12 inches of the subsoil is gray silt loam. The lower 29 inches is grayish brown and pale brown silty clay loam. The substratum to a depth of 60 inches or more is brown clay loam.

Permeability is moderate in the Wetterdon soil. Available water capacity is high. The effective rooting

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

The Recluse soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is grayish brown very fine sandy loam about 3 inches thick. The upper 9 inches of the subsoil is dark grayish brown clay loam. The next 18 inches is dark yellowish brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown clay loam and silty clay loam.

Permeability is moderate in the Recluse soil. Available water capacity is high. The 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 nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main management concerns are the hazards of wind and water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

300—Wibaux-Reddale association, 3 to 15 percent slopes. This map unit is on tablelands characterized by numerous swales and hills. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 4,000 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Wibaux channery loam, 6 to 15 percent slopes, on hillcrests and 30 percent Reddale very fine sandy loam, 3 to 9 percent slopes, on hillslopes and in swales between the hills.

Included in this unit are small areas of Harlan loam and Shingle silt loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Wibaux soil is very deep and somewhat excessively drained. It formed in residuum derived from porcellanite. Typically, the surface layer is light reddish brown channery loam about 5 inches thick. The upper 7 inches of the underlying material is reddish brown very channery loam. The lower part to a depth of 60 inches or more is displaced, fractured porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to the fractured porcellanite material ranges from 10 to 20 inches.

Permeability in the Wibaux soil is moderate in the upper part of the underlying material and very rapid in the lower part. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

The Reddale soil is very deep and well drained. It formed in residuum derived from interbedded shale and porcellanite. Typically, the surface layer is light reddish brown and pinkish gray very fine sandy loam about 4 inches thick. The upper 3 inches of the subsoil is pink loam. The next 9 inches is reddish brown clay. The lower 8 inches is reddish brown clay loam. The substratum to a depth of 60 inches or more is displaced, fractured porcellanite material that has little or no earthy material in the many voids between the rock fragments. Depth to fractured porcellanite material ranges from 20 to 40 inches.

Permeability in the Reddale soil is very slow in the subsoil and very rapid in the substratum. Available water capacity is low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Wibaux soil is mainly bluebunch wheatgrass, western wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Reddale soil is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Wibaux soil is limited by droughtiness. The Reddale soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability for rangeland seeding is poor on the Wibaux soil and good on the Reddale soil. The main limitations affecting seeding on the Wibaux soil are droughtiness, the hazard of water erosion, and the rock fragments in the surface layer. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope.

The Wibaux soil is in capability subclass VIIs, nonirrigated, and the Reddale soil is in capability subclass IVe, nonirrigated. The Wibaux soil is in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Reddale soil is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

301—Windham gravelly loam, 3 to 85 percent slopes. This very deep, well drained soil is on pediments, fan terraces, and adjacent escarpments of the numerous deep valleys. It formed in alluvium and colluvium derived from sandstone, quartzite, and limestone. The native vegetation is mainly grasses and shrubs. Elevation is 3,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Included in this unit are small areas of Baux soils, shale outcrop, Eltsac clay, Reget silt loam, Reeder loam, Savage loam, and Norbert clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown gravelly loam about 9 inches thick. The upper 7 inches of the subsoil is pale brown very gravelly loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly loam.

Permeability is moderate in the Windham soil. Available water capacity also is moderate. The 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. Slippage and soil creep are very common on the steeper slopes.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is Idaho fescue, bluebunch wheatgrass, needleandthread, little bluestem, and big sagebrush. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. The suitability of this unit for rangeland

seeding is poor. The main limitations affecting seeding are the gravelly surface layer and the slope.

This map unit is in capability subclass VIIe, nonirrigated, and is in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

302—Wolf loam, 0 to 3 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from sedimentary rock over outwash. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam, Wolfvar loam, Platsher loam, and Nuncho clay loam. Also included are small areas of a soil that is similar to the Wolf soil but has a gravelly layer below a depth of 20 inches and some areas near the foothills of the Big Horn Mountains and on terrace breaks that have cobbles and boulders on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark brown loam about 2 inches thick. The upper 6 inches of the subsoil is dark brown and dark yellowish brown clay loam. The next 6 inches is light brownish gray clay loam. The lower part to a depth of 60 inches or more is white gravelly loam. Depth to the gravelly layer, the cobbly layer, or both ranges from 10 to 20 inches. In some areas the subsoil below a depth of 40 inches is gravelly sandy loam or gravelly loamy sand.

Permeability is moderate in the Wolf soil. Available water capacity is high. The 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.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for irrigated and nonirrigated crops.

If this unit is used for crops, the main limitation is droughtiness. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, western wheatgrass, needleandthread, green needlegrass, and big sagebrush. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

303—Wolf loam, 3 to 6 percent slopes. This very deep, well drained soil is on terraces and alluvial fans. It formed in alluvium derived from sedimentary rock over outwash material. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Recluse loam, Platsher loam, Nuncho clay loam, and Wolfvar loam. Also included are small areas of a soil that is similar to the Wolf soil but has a gravelly layer below a depth of 20 inches and small areas near the foothills of the Big Horn Mountains and on terrace breaks that have cobbles and boulders on the surface. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is dark grayish brown loam about 2 inches thick. The upper part of the subsoil is dark grayish brown clay loam about 10 inches thick. The next 24 inches is light gray gravelly sandy loam. The lower part to a depth of 60 inches or more is light yellowish brown cobbly sandy loam. Depth to the gravelly layer, the cobbly layer, or both ranges from 10 to 20 inches. In some areas the

subsoil below a depth of 40 inches is gravelly sandy loam or gravelly loamy sand.

Permeability is moderate in the Wolf soil. Available water capacity also is moderate. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is droughtiness. Irrigation water needs to be applied at a rate that ensures optimum production without increasing deep percolation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, western wheatgrass, needleandthread, green needlegrass, and big sagebrush. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

304—Worfka-Shingle-Samday complex, 6 to 30 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Worfka fine sandy loam, 30 percent Shingle clay loam, and 20 percent Samday 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 Renohill clay loam, Theedle loam, and shale outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Worfka soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is grayish brown fine sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown clay and clay loam about 7 inches thick. The lower part is light yellowish brown clay about 3 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Worfka soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of wind erosion also is severe.

The Shingle soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light yellowish brown clay loam about 1 inch thick. The underlying material is light yellowish brown clay loam about 14 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Samday soil is shallow and well drained. It formed in residuum derived from shale. Typically, the surface layer is light brownish gray clay loam about 1 inch thick. The underlying material is light brownish gray clay about 18 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Worfka and Shingle soils is mainly bluebunch wheatgrass, western

wheatgrass, blue grama, and needleandthread. 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. As the ecological condition deteriorates, blue grama and threadleaf sedge increase. As the ecological condition further deteriorates, broom snakeweed and plains pricklypear invade.

The potential plant community on the Samday soil is mainly bluebunch wheatgrass, western wheatgrass, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and birdfoot sagebrush increase. As the ecological condition further deteriorates, broom snakeweed and annuals invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIIe, nonirrigated. The Worfka and Shingle soils are in the Shallow Loamy, 10- to 14-inch precipitation zone, Northern Plains range site, and the Samday soil is in the Shallow Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

305—Worfka-Shingle-Samday complex, moist, 6 to 30 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 35 percent Worfka loam, 25 percent Shingle clay loam, and 25 percent Samday 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 Renohill clay loam, Theedle loam, and shale outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Worfka soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is brown loam about 1 inch thick. The upper part of the subsoil is brown clay about 8 inches thick. The lower part is pale brown clay loam about 10 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is fine sandy loam.

Permeability is slow in the Worfka soil. Available water capacity is very low. The 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 Shingle soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light yellowish brown clay loam about 2 inches thick. The underlying material is light yellowish brown clay loam about 17 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability is moderate in the Shingle soil. Available water capacity is very low. The 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 Samday soil is shallow and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is light gray clay loam about 2 inches thick. The underlying material is grayish brown clay about 15 inches thick over soft shale. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is clay.

Permeability is slow in the Samday soil. Available water capacity is very low. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Worfka and Shingle soils is mainly Idaho fescue, bluebunch wheatgrass, needleandthread, and little bluestem. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, threadleaf sedge and unpalatable forbs increase. As the ecological condition

further deteriorates, Kentucky bluegrass, red threeawn, and twogroove milkvetch invade.

The potential plant community on the Samday soil is mainly western wheatgrass, little bluestem, green needlegrass, and spike fescue. 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 900 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, prairie junegrass, and forbs increase. As the ecological condition further deteriorates, annuals and broom snakeweed invade.

The production of vegetation suitable for livestock grazing is limited by droughtiness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor. The main limitations affecting seeding are droughtiness and the hazard of water erosion. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope, but tillage is not recommended in areas that have a slope of more than 15 percent.

This map unit is in capability subclass VIIe, nonirrigated. The Worfka and Shingle soils are in the Shallow Loamy, 15- to 19-inch precipitation zone, Northern Plains range site, and the Samday soil is in the Shallow Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

306—Worthenton clay loam, 0 to 3 percent slopes. This very deep, poorly drained soil is in oxbows on flood plains and in drainageways. It formed in alluvium derived from shale. Areas are elongated and irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly water-tolerant grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Haverdad fine sandy loam. Also included in this unit are small areas of swamps and water. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface is covered with a thin mat of partly decomposed roots. The surface layer is gray clay loam about 8 inches thick. The upper 11 inches of the subsoil is gray silty clay loam. The next 17 inches is greenish gray clay. The lower part to a depth of 60 inches or more is light greenish gray clay loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 6 to 18 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. A fluctuating seasonal high water table is at a depth of 0.5 foot to 1.5 feet from March through July and is at a depth of 1.5 to 3.0 feet the rest of the year. This soil is subject to occasional flooding for brief periods from March through June.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly northern reedgrass, bluejoint reedgrass, Nebraska sedge, and tufted hairgrass. The potential plant community produces about 5,000 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. As the ecological condition deteriorates, spike sedge, inland sedge, and Baltic rush increase. As the ecological condition further deteriorates, annuals and cocklebur invade.

The production of vegetation suitable for livestock grazing is limited by the wetness. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is poor because of the wetness. The wetness limits the use of mechanical equipment on this soil. Plants that are selected for seeding should tolerate wet soils.

This map unit is in capability subclass VIw, nonirrigated, and is in the Wetland, 10- to 14-inch precipitation zone, Northern Plains range site.

307—Worthenton-Recluse association, 0 to 3 percent slopes. This map unit is on terraces and in drainageways. Areas are elongated and are 10 to 200 acres in size. The native vegetation is mainly grasses, shrubs, and deciduous trees. The canopy cover is 10 to 25 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is about 110 to 120 days.

This unit is 40 percent Worthenton loam in drainageways and 40 percent Recluse loam on the adjacent terraces.

Included in this unit are small areas of Cedak loam, Havertel silt loam, Coaliams loam, Clarkelen loam, and Kishona loam. Also included are small areas of a soil that is similar to the Worthenton soil but contains strata of porcellanite and sandstone fragments. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Worthenton soil is very deep and poorly drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface is covered with a thin mat of partly decomposed roots. The surface layer is grayish brown loam about 7 inches thick. The upper part of the subsoil is dark gray silty clay about 12 inches thick. The lower part to a depth of 60 inches or more is olive gray silty clay loam and clay loam.

Permeability is slow in the Worthenton soil. Available water capacity is high. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 6 to 18 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to occasional flooding for brief periods from March through June. A fluctuating seasonal high water table is at a depth of 0.5 foot to 1.5 feet from March through July and is at a depth of 1.5 to 3.0 feet the rest of the year.

The Recluse soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is dark grayish brown loam about 3 inches thick. The upper 7 inches of the subsoil is dark grayish brown loam. The next 9 inches is grayish brown silty clay loam. The next part to a depth of 38 inches is pale brown loam. The lower part to a depth of 60 inches or more is grayish brown fine sandy loam.

Permeability is moderate in the Recluse soil. Available water capacity is high. The 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 livestock grazing and wildlife habitat.

The potential plant community on the Worthenton soil is mainly Nebraska sedge, northern reedgrass, bluejoint reedgrass, and tufted hairgrass. The potential plant community produces about 5,600 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 5,000 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge and willows increase. As the ecological condition further deteriorates, cocklebur and other annuals invade.

The potential plant community on the Recluse soil is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

The production of vegetation suitable for livestock grazing on the Worthenton soil is limited by the wetness. The Recluse soil has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Brush management on the Recluse soil improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community. The suitability of the Worthenton soil for rangeland seeding is poor because of the wetness. The suitability of the Recluse soil for rangeland seeding is good. The wetness limits the use of mechanical equipment on the Worthenton soil. Plants that are selected for seeding on the Worthenton soil should tolerate wet soils.

The Worthenton soil is in capability subclass VIw, nonirrigated, and the Recluse soil is in capability subclass IIIe, nonirrigated. The Worthenton soil is in the Wetland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Recluse soil is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

308—Worthenton Variant-Assinniboine Variant association, 0 to 6 percent slopes. This map unit is on terraces and in drainageways. Areas are elongated and are 20 to 75 acres in size. The native vegetation is mainly sedges, shrubs, forbs, and ponderosa pine. The canopy cover on the Assinniboine Variant soil is 75 to 100 percent. Elevation is 4,900 to 5,500 feet. The average annual precipitation is 15 to 19 inches, the average annual temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is 50 percent Worthenton Variant loam, 0 to 3 percent slopes, in drainageways and 30 percent Assinniboine Variant sandy loam, 0 to 6 percent slopes, on terraces.

Included in this unit are small areas of water and Cloud Peak Variant very fine sandy loam. Included

areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Worthenton Variant soil is very deep and very poorly drained. It formed in alluvium derived from shale over alluvium derived from granite. Typically, the surface is covered with a mat of partly decomposed organic material about 1 inch thick. The surface layer is very dark gray loam 8 inches thick. The subsoil is greenish gray sandy clay loam 16 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand. Depth to the extremely bouldery layer ranges from 20 to 40 inches.

Permeability in the Worthenton Variant soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is less than 12 inches for most plants. 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 less than 1 foot during most of the year. This soil is subject to rare flooding.

The Assinniboine Variant soil is very deep and somewhat poorly drained. It formed in alluvium derived from shale over alluvium derived from granite. Occasional stones and boulders are on the surface. Typically, the surface layer is dark gray sandy loam about 3 inches thick. The subsoil is dark gray sandy clay loam 32 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown extremely bouldery coarse sand. Depth to the extremely bouldery layer ranges from 20 to 40 inches.

Permeability in the Assinniboine Variant soil is moderate in the subsoil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more for plants that can tolerate a water table, but it is 24 to 36 inches for most plants. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is severe. A fluctuating water table is a depth of 2 to 3 feet from March through November. This soil is subject to rare flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Worthenton Variant soil is mainly Nebraska sedge, northern reedgrass, tufted hairgrass, and Baltic rush. The potential plant community produces about 6,000 pounds of air-dry vegetation per acre in normal years. Production varies from 7,000 pounds in favorable years to 4,500 pounds in unfavorable years. As the ecological condition deteriorates, spike sedge and willows increase. As the ecological condition further deteriorates, annuals and cocklebur invade.

The plant community on the Assinniboine Variant soil is mainly ponderosa pine with an understory of common chokecherry, black hawthorn, silver buffaloberry, Kentucky bluegrass, and slender wheatgrass.

The production of vegetation suitable for livestock grazing on the Worthenton Variant soil is limited by the wetness. The production of vegetation suitable for livestock grazing on the Assinniboine Variant soil is limited by the canopy cover. The suitability of the Worthenton Variant soil for rangeland seeding is poor because of the wetness. Seeding the Assinniboine Variant soil is suitable, but it is not practical because of the canopy cover. The wetness limits the use of mechanical equipment on the Worthenton Variant soil. Plants that are selected for seeding on the Worthenton Variant soil should tolerate wet soils.

The Worthenton Variant soil is in capability subclass VIw, nonirrigated, and the Assinniboine Variant soil is in capability subclass IIIw, nonirrigated. The Worthenton Variant soil is in the Wetland, 15- to 19-inch precipitation zone, Northern Plains range site, and the Assinniboine Variant soil is a woodland site.

309—Wyarno clay loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Kishona loam and soils that are similar to the Wyarno soil but are calcareous throughout. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 5 inches thick. The upper 4 inches of the subsoil is light brownish gray silty clay loam. The next 3 inches is grayish brown clay loam. The lower part to a depth of 60 inches or more is light brownish gray clay loam. In cultivated areas the surface layer is darker. In some areas the subsoil below a depth of 40 inches is loam or sandy clay loam.

Permeability is slow in the Wyarno soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, blue grama, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

310—Wyarno clay loam, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Kishona loam and soils that are similar to the Wyarno soil but are calcareous throughout. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is brown clay loam about 2 inches thick. The upper part of the subsoil is pale brown clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is light brownish gray clay loam. In cultivated areas the surface layer is clay loam and is darker.

Permeability is slow in the Wyarno soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitation is the clay loam surface layer. If this unit is used for irrigated crops, the slow permeability is also a limitation. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, blue grama, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in

excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

311—Wyarno clay loam, 6 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and hillslopes. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Renohill clay loam and soils that are similar to the Wyarno soil but are calcareous throughout. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 3 inches thick. The upper part of the subsoil is brown clay about 6 inches thick. The lower part to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Wyarno soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main limitations are the clay loam surface layer and the hazard of water erosion. If this unit is used for irrigated crops, the slope and the slow permeability are also limitations. Irrigation water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone, but it needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. Chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly green needlegrass, western wheatgrass, Idaho fescue, blue grama, and sideoats grama. The potential plant community produces about 2,100 pounds of air-dry vegetation per acre in normal years. Production varies from 2,900 pounds in favorable years to 1,400 pounds in unfavorable years. As the ecological condition deteriorates, blue grama, Sandberg bluegrass, and big sagebrush increase. As the ecological condition further deteriorates, Kentucky bluegrass and locoweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Clayey, 15- to 19-inch precipitation zone, Northern Plains range site.

312—Wyarno clay loam, dry, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Kishona loam and soils that are similar to the Wyarno soil but are calcareous to the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 3 inches thick. The upper part of the subsoil is pale brown clay about 7 inches thick. The lower part to a depth of 60 inches or more is light brownish gray clay loam. In some areas the surface layer is loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Wyarno soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer and the low annual precipitation. If this unit is used for irrigated crops, the main limitations are the clay loam surface layer and the slow permeability. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

313—Wyarno clay loam, dry, 3 to 6 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from shale. Areas are deltaic and irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Ulm clay loam and Kishona loam. Also included are soils that are similar to the Wyarno soil but are calcareous to the surface. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is pale brown clay loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Wyarno soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer and the low annual precipitation. If this unit is used for irrigated crops, the main limitations are the clay loam surface layer and the slow permeability. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. A tillage pan forms easily if this soil is tilled

during wet periods. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

314—Wyarno clay loam, dry, 6 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and hillslopes. It formed in alluvium derived from shale. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Bahl clay loam, Renohill clay loam, and Zigweid loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is light brownish gray clay loam about 4 inches thick. The upper part of the subsoil is grayish brown clay about 6 inches thick. The lower part to a depth of 60 inches or more is light yellowish brown clay loam. In cultivated areas the surface layer is darker.

Permeability is slow in the Wyarno soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of wind erosion also is moderate.

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the clay loam surface layer, the hazard of water erosion, and the low annual precipitation. If this unit is used for irrigated crops, the main limitations are the clay loam surface layer, the hazard of water erosion, the slope, and the slow permeability. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Water needs to be applied at a slow rate over an adequate period to ensure sufficient wetness in the root zone. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. A tillage pan forms easily if this soil is tilled during wet periods. Chiseling or subsoiling breaks up the tillage pan. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Maintaining crop residue on or near the surface helps to control runoff and erosion. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, and blue grama. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear and cheatgrass invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this soil for rangeland seeding is good. Where blue

grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Clayey, 10- to 14-inch precipitation zone, Northern Plains range site.

315—Zigweid loam, 0 to 3 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in alluvium derived from interbedded sedimentary rock. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

Included in this unit are small areas of Forkwood loam, Kishona loam, and Cambria loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Typically, the surface layer is pale brown loam about 2 inches thick. The upper part of the subsoil is brown clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is pale brown loam. In cultivated areas the surface layer is darker.

Permeability is moderate in the Zigweid soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If used for irrigated crops, this unit has few limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

316—Zigweid-Cambria loams, 0 to 6 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular and deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 50 percent Zigweid 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 Forkwood loam, Kishona loam, and Wyarno clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Zigweid soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is brown loam about 4 inches thick. The upper part of the subsoil is light yellowish brown clay loam about 9 inches thick. The lower part to a depth of 60 inches or more is pale brown loam.

Permeability is moderate in the Zigweid soil. Available water capacity is high. The 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 interbedded

sedimentary rock. Typically, the surface layer is brown loam about 3 inches thick. The upper part of the subsoil is brown silty clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is very pale brown loam and clay loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for irrigated and nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitation is the low annual precipitation. If used for irrigated crops, this unit has few limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated, and IVe, nonirrigated, and is in the Loamy, 10- to 14-inch precipitation zone, Northern Plains range site.

317—Zigweid-Kishona-Cambria complex, 6 to 15 percent slopes. This map unit is on hillslopes and alluvial fans. Areas are irregular and deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 12 to 14 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Zigweid fine sandy loam, 30 percent Kishona loam, and 25 percent Cambria loam. The percentages change from one area to another. 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 and Cushman loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Zigweid soil is very deep and well drained. It formed in alluvium derived from interbedded sedimentary rock. Typically, the surface layer is pale brown fine sandy loam about 1 inch thick. The upper part of the subsoil is light yellowish brown loam about 10 inches thick. The lower part to a depth of 60 inches or more is very pale brown loam.

Permeability is moderate in the Zigweid soil. Available water capacity is high. The 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 sedimentary rock. Typically, the surface layer is grayish brown loam about 5 inches thick. The subsoil to a depth of 60 inches or more is light yellowish brown loam and clay loam. In some areas the surface layer is fine sandy loam or clay loam.

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

The Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is brown loam about 2 inches thick. The upper 4 inches of the subsoil is dark

yellowish brown clay loam. The lower part to a depth of 60 inches or more is yellowish brown loam.

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

This unit is used mainly for livestock grazing and wildlife habitat. A few areas are used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the low annual precipitation and the hazard of water erosion. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation.

The potential plant community on this unit is mainly western wheatgrass, needleandthread, blue grama, and green needlegrass. 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. As the ecological condition deteriorates, big sagebrush and blue grama increase. As the ecological condition further deteriorates, plains pricklypear, cheatgrass, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is fair. If the existing plant cover is removed during seeding, a cover crop is needed to minimize the hazard of erosion. Tillage should be along the contour of the slope. Where blue grama is the dominant vegetation, pitting, furrowing, chiseling, or other management practices can be used to improve deteriorated areas of rangeland. These practices increase the rate of water infiltration, control plant competition, and allow the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

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

318—Zigweid-Kishona-Cambria complex, moist, 0 to 3 percent slopes. This map unit is on terraces and alluvial fans. Areas are irregular and deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Zigweid loam, 30 percent Kishona fine sandy loam, and 25 percent Cambria loam. Percentages vary from one area to another. 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, Haverdad loam, and Wyarno clay loam. Also included in this unit are small areas of a soil that is similar to the Kishona soil but contains strata of sand or gravel in the lower part of the subsoil. These soils generally are adjacent to drainageways and on fan terraces. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Zigweid soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper 10 inches of the subsoil is brown clay loam. The next 16 inches is yellowish brown clay loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Permeability is moderate in the Zigweid soil. Available water capacity is high. The 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 Kishona soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown fine sandy loam about 2 inches thick. The subsoil to a depth of 60 inches or more is very pale brown loam. In some areas the surface layer is loam or clay loam.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper 5 inches of the subsoil is dark yellowish brown clay loam. The next 8 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is very pale brown loam and clay loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for crops, this unit has few limitations. Returning crop residue to the soil or regularly adding other organic matter improves fertility, minimizes crusting, and increases the rate of water intake. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

319—Zigweid-Kishona-Cambria complex, moist, 3 to 6 percent slopes. This map unit is on alluvial fans, terraces, and hillslopes. Areas are irregular and deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Zigweid loam, 30 percent Kishona fine sandy loam, and 25 percent Cambria loam. Percentages vary from one area to another. 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 Wyarno clay loam, Forkwood loam, and Theedle loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Zigweid soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper part of the subsoil is pale brown clay loam about 10 inches thick. The lower part to a depth of 60 inches or more is pale brown loam and clay loam.

Permeability is moderate in the Zigweid soil. Available water capacity is high. The 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 Kishona soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown fine sandy loam about 1 inch thick. The subsoil to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is loam or clay loam.

Permeability is moderate in the Kishona soil. Available water capacity is high. The 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 Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is brown loam about 3 inches thick. The upper 7 inches of the subsoil is brown silty clay loam. The next 21 inches is pale brown clay loam. The lower part to a depth of 60 inches or more is yellowish brown silty clay loam. In some areas the surface layer is loam.

Permeability is moderate in the Cambria soil. Available water capacity is high. The 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 irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If used for crops, this unit has few limitations. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IIIe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.

320—Zigweid-Kishona-Cambria loams, moist, 6 to 9 percent slopes. This map unit is on hillslopes, terraces, and alluvial fans. Areas are irregular and deltaic in shape and are 50 to 500 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 120 days.

This unit is 30 percent Zigweid loam, 30 percent Kishona loam, and 20 percent Cambria loam. Percentages vary from one area to another. 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 fine sandy loam, Cushman loam, and Forkwood loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Zigweid soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown loam about 1 inch thick. The upper 11 inches of the subsoil is pale brown clay loam. The next 14 inches is light gray clay loam. The lower part to a depth of 60 inches or more is light gray loam.

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

The Kishona soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is brown loam about 1 inch thick. The subsoil to a depth of 60 inches or more is light yellowish brown loam. In some areas the surface layer is fine sandy loam or clay loam.

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

The Cambria soil is very deep and well drained. It formed in alluvium derived from sedimentary rock. Typically, the surface layer is pale brown loam about 2 inches thick. The upper 6 inches of the subsoil is yellowish brown clay loam. The next 8 inches is light yellowish brown loam. The lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam.

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

This unit is used for irrigated and nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for crops, the main management concern is the hazard of water erosion. The slope is also a limitation if this unit is used for irrigated crops. Maintaining crop residue on or near the surface helps to control runoff and erosion and helps to maintain tilth and the content of organic matter. Early seeding of fall grain, stubble-mulch tillage, and tillage and seeding on the contour or across the slope can help to control erosion. Waterways should be shaped and seeded to perennial grass. On long slopes, chiseling the stubble in the fall slows runoff and controls the loss of soil in years when the snow melts rapidly while the soil is still frozen. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Grain and grasses respond to nitrogen. Legumes respond to phosphorus, boron, and sulfur. To prevent overirrigating and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

The potential plant community on this unit is mainly Idaho fescue, spike fescue, green needlegrass, and western wheatgrass. The potential plant community produces about 2,200 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable years to 1,500 pounds in unfavorable years. As the ecological condition deteriorates, big sagebrush, silver sagebrush, and unpalatable forbs increase. As the ecological condition further deteriorates, locoweed, red threeawn, and broom snakeweed invade.

This unit has few limitations affecting plants that are suitable for livestock grazing. Grazing during wet periods compacts the surface layer, which results in excessive runoff. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases; therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. The suitability of this unit for rangeland seeding is good. Range renovation can be used to improve deteriorated areas of rangeland. This practice increases the rate of water infiltration, controls plant competition, and allows the desirable native plants to increase. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the potential plant community.

This map unit is in capability subclass IVe, irrigated and nonirrigated, and is in the Loamy, 15- to 19-inch precipitation zone, Northern Plains range site.