



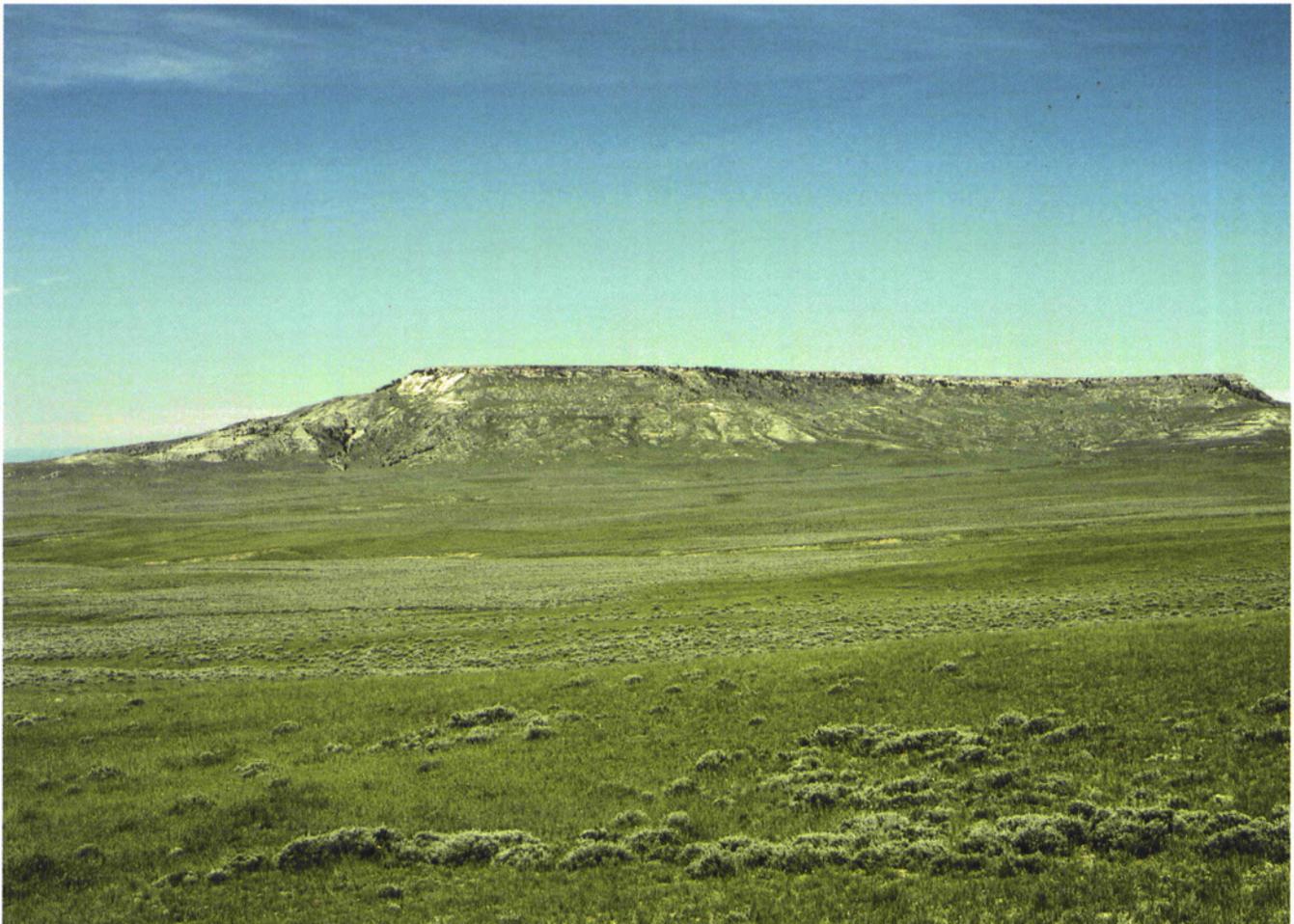
United States  
Department of  
Agriculture



Natural  
Resources  
Conservation  
Service

In cooperation with the  
University of Wyoming  
Agricultural Experiment  
Station, United States  
Forest Service, and the  
Bureau of Land  
Management

# Soil Survey of Campbell County, Wyoming, Southern Part Part I





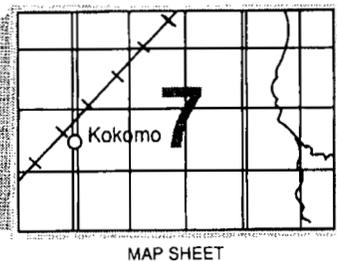
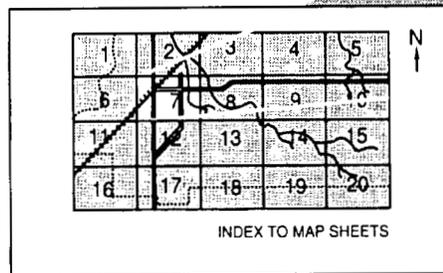
# How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the detailed soil map units and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

## General Soil Map

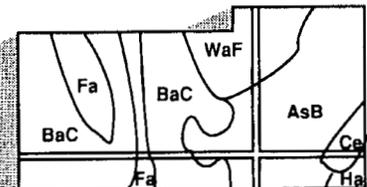
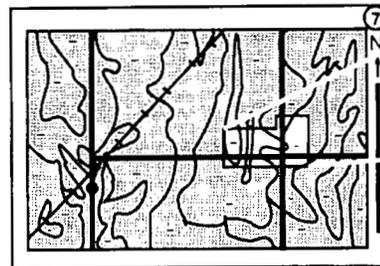
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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.



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.

To find information about your area of interest, locate that area in 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 unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

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

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

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1995. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1995. This survey was made cooperatively by the Natural Resources Conservation Service and the Bureau of Land Management, Forest Service, Wyoming Agricultural Experiment Station, and University of Wyoming Extension Service. The survey is part of the technical assistance furnished to the Intermountain Soil and Water Conservation District.

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

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**Cover:** This landform is a result of the resistance of the overlying material (hard conglomerate sandstone and siltstone of the White River formation) to weathering and erosion. The White River formation is more resistant to weathering than the underlying Wasatch formation.

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

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Land Capability and Yields Per Acre of Crops and Pasture

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Wildlife Habitat

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Water Management

Engineering Index Properties

Physical Properties of the Soils

Chemical Properties of the Soils

Soil Features

Water Features



# Foreword

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

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are 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 (Ed) Burton  
State Conservationist  
Natural Resources Conservation Service



# Soil Survey of Campbell County, Wyoming, Southern Part

By James W. Westerman and Craig Prink, Natural Resources Conservation Service

Fieldwork by James W. Westerman, Paul J. Lupcho, Andrew E. Kinney, Randall W. White, and Gordon F. Kee, Jr., Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,  
in cooperation with  
United States Department of Interior, Bureau of Land Management; United States  
Department of Agriculture, Forest Service; Wyoming Agricultural Experiment Station;  
and University of Wyoming - Extension Service.

This survey updates the survey "Soil Survey Reconnaissance Campbell County, Wyoming" published in 1955 (USDA, SCS). This survey provides additional information and has larger maps which show the soils in greater detail.

## General Nature of the Survey Area

This section gives general information about the survey area. It discusses physiography, relief, and drainage; geology; natural resources; and climate.

Campbell County, Southern Part, is in the northeastern part of Wyoming (fig. 1). The survey area includes that portion of Campbell County south of Township 51 North, with an area of 1,793,243 acres. Of this, about 1,503,601 acres are privately owned, 68,078 acres are administered by the Bureau of Land Management, and 110,844 acres are administered by the Forest Service as part of the Thunder Basin National Grassland. The state administers 110,720 acres.

Agriculture in the survey area is characterized by cattle and sheep production. Approximately 75,000 acres are used for production of commodity crops such as winter wheat, alfalfa hay, and other small grains. The survey area contains significant mineral reserves. Coal, oil, and natural gas are the principle mineral resources produced in the area. This area also provides habitat for a wide variety of game and non-game species. A large population of pronghorn antelope and mule deer inhabit the area.

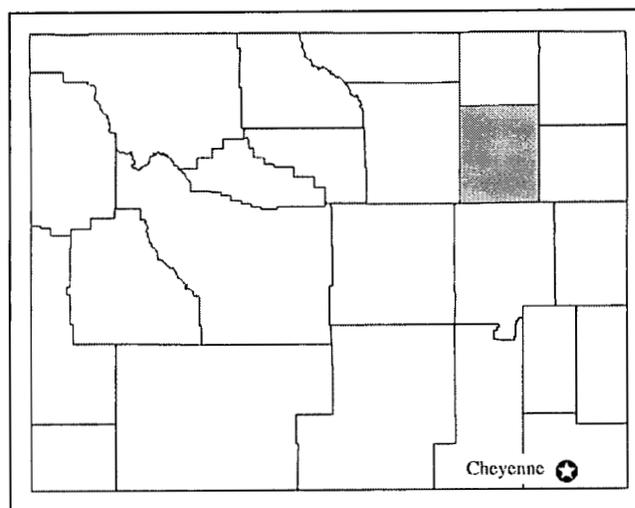


Figure 1. Location of Campbell County, Southern Part, in Wyoming.

This soil survey was made largely to satisfy the demands for resource information brought about by rapid energy development. Most of the mapping was done at an intensity that will facilitate management of the soils for livestock grazing and broad-scale mine land reclamation. In those parts of the survey area where commodity crops are produced, mapping was done so as to facilitate management of the soils for more intense agricultural uses. The lower detail of mapping done on rangeland does not preclude the use of the survey for farm management and reclamation, if the limitations of the lower intensity mapping are duly considered.

This survey area adjoins published surveys in Crook County and Weston County, as well as Converse County, Northern Part and Johnson County, Southern Part. Some of the names of adjoining general soil map units and detailed soil map units in this survey are not the same as those in the adjoining soil surveys. The collection of more recent data on the soils has led to the recorrelation, reclassification, or renaming of map units in the Campbell County, Southern Part survey area.

### Physiography, Relief, and Drainage

The survey area is in the southern part of the northern rolling high plains. Much of the area can be characterized as rolling prairies. The Rochelle Hills occur as steep breaks along the eastern edge and support the only continuous stand of coniferous trees in the area. The Pumpkin Buttes stand as landmarks in the southwest corner of the survey area. Elevation ranges from about 4,100 feet where Dead Horse Creek leaves the area in the northwest corner, to 6,052 feet on top of the north Pumpkin Butte. The elevation is 4,544 feet at Gillette and 5,010 feet at Wright. Most of the area is 4,400 to 5,300 feet in elevation.

The survey area is drained by three river basins. The southern and extreme eastern part of the area drains in a southeasterly direction, towards the Cheyenne River in Converse County and Weston County. The major drainages include Bates, Black Thunder, Little Thunder, Ninemile, and Spring Creeks. The central and northern part of the area is drained by the Belle Fourche River, which has its headwaters southeast of the Pumpkin Buttes. Drainage is towards the northeast. Major tributaries include Caballo, Donkey, Hay, and Hoe Creeks. The western edge of the area drains toward the Powder River in Johnson County. The major drainages include Beaver, Cottonwood, Dead Horse, and Pumpkin Creeks.

### Geology

P. Stanley Mitchem, geologist, Natural Resources Conservation Service, assisted in the preparation of this section.

Campbell County, Southern Part, lies along the eastern margin of the Powder River structural basin. The basin is bordered by the Bighorn Mountains to the west and the Black Hills to the east. The basin was formed during the Laramide orogeny, at the

close of the Cretaceous period, about 60 million years ago. As the mountains rose and were subsequently eroded, the basin filled with sediments. Erosion has since removed some of these sediments and has shaped the remaining ones to create present-day landforms.

During Tertiary time, the survey area was covered intermittently with swamps and marshes, which produced dense, subtropical vegetation. These swamps and marshes were eventually buried by sediments from surrounding landforms. These sediments dip gently to the west and comprise the sandstones and shales of the present Fort Union, Wasatch, and White River Formations which are exposed in the survey area.

The Fort Union formation underlies the entire survey area, but is only exposed at the surface along the eastern one-third. The formation consists of silty and clayey shales and concretionary sandstones. The shale and sandstone members of this formation are exposed in the escarpments and breaks of the Rochelle Hills and drainages along the eastern edge of the survey area. Numerous thin to thick coal seams, a result of the burial of subtropical vegetation once covering the area, occur within this formation and crop out in many areas. The Fort Union Formation is one of the most important coal producers in the state with 8 to 12 feet thick coal seams. One seam, the Wyodak, ranges in thickness from 70 to 120 feet (Brekenridge et al., 1974).

The Wasatch Formation overlies the Fort Union Formation and occurs in the western two-thirds of the survey area. It consists primarily of interbedded sandstone and shale, and has a few coal seams in the lower part of the formation. Many of the areas where Wasatch coals crop out have burned through natural or man-made causes. The fires have left behind beds of hard, red, clinker-like material. This material, locally known as scoria, is porcelanite. Porcelanite is produced by the baking and fusing of clays in shale immediately surrounding the burning coal. The extreme resistance of this material to erosion, coupled with the unequal thickness of the beds, has resulted in the formation of a number of red porcelanite hills ranging in height from less than 20 to more than 100 feet.

The White River formation is the youngest Tertiary bedrock in the survey area. It is composed of hard, semi-cemented conglomeratic sandstone overlying siltstones and shales. Its only occurrence in the survey area is at Pumpkin Buttes, where the resistant sandstone forms a protective cap atop the buttes.

The White River and Wasatch Formation are exposed in the ledges and escarpments which form the sides of the buttes.

## Natural Resources

Important natural resources in the survey area are the soil, minerals, and grasses. The mineral resources include coal, oil, and natural gas in addition to construction materials and uranium.

Coal deposits underlie much of the survey area, but with the dip of the bedrock, their proximity to the surface is the least in the eastern one-third of the area. Development and production of these resources has led to significant cultural development in the area. The first open pit coal mine in Wyoming, the Wyodak Resources Mine east of Gillette, opened in 1925. Since that time, nine additional mines have gone into production, and five more are in the planning stages. The survey area has one of the largest coal reserves in the world, The coal reserves of Campbell County could meet the nation's needs for the next 200 years (Lageson and Spearing, 1988). The county currently produces over 80 percent of coal produced in the Wyoming, and by 1995, is expected to produce nearly 200 million tons annually (Jones, 1991.)

Commercial oil and gas activity in Campbell County began in the late 1940s, but the first significant oil discovery occurred in 1956 at Raven Creek in the northeastern part of the survey area. Discovery of the Hilight field in February 1969, with over 200 producing wells, is the largest field in the county, and was one of the more significant finds in northeastern Wyoming. Two fields, Hartzog Draw and Buck Draw North, currently rank among the top oil producers in the state (De Bruin, 1990). Since the late 1980s, coal bed methane gas exploration and production has begun in the central areas of the county.

While the future of uranium mining in the United States and Wyoming is uncertain, Wyoming had for many years been the leading uranium-producing state (Harris, 1990). Commercial grade uranium was first discovered in Wyoming at Pumpkin Buttes in 1951. Since 1953, a total of at least 56 different mines have been in operation in the survey area (Brekenridge, 1974). At present, two in-situ uranium mines are proposed in this area (Jones, 1991).

Numerous sand, gravel, and scoria pits can be found in the survey area. These materials are used for aggregate, highway and railroad construction, and

other building purposes. Sands and gravels occur as alluvial deposits and are limited primarily to the low terraces along the Belle Fourche River. Scoria deposits occur erratically throughout the eastern and north-central part of the survey area. The suitability of scoria varies considerably, but it has been quarried and used as road gravel, creating red-colored roads (Lageson and Spearing, 1988).

## Climate

The table, "Temperature and Precipitation," gives data on temperature and precipitation for the survey area as recorded at Gillette, Wyoming in the period 1961 to 1990. The table shows probable dates of the first freeze in fall and the last freeze in spring. The table, "Freeze Dates in Spring and Fall," provides data on length of the growing season.

In winter, the average temperature is 23.4 degrees F and the average daily minimum temperature is 12.8 degrees. In summer, the average temperature is 67.5 degrees and the average daily maximum temperature is 82.5 degrees.

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

The total annual precipitation is about 16.7 inches. Of this, 12.2 inches, or 73 percent, usually falls in April through September. The growing season for most crops falls within this period. In 3 years out of 10, the rainfall in April through September is less than 6.9 inches. Thunderstorms occur on about 26 days each year, and most occur in April through July.

The average seasonal snowfall is about 66 inches.

## How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil

profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

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

they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

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

## Temperature and Precipitation

(Recorded in the period 1961-90 at Gillette, Wyoming)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average total snow- fall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
January----	31.6	10.3	20.9	56	-25	3	0.54	0.24	0.79	1	9.3
February---	36.8	15.6	26.2	60	-19	10	0.56	0.26	0.82	1	8.8
March-----	44.7	21.8	33.3	70	-9	48	0.83	0.47	1.14	2	10.9
April-----	55.6	30.5	43.1	81	9	165	1.86	0.86	2.72	5	9.9
May-----	65.5	39.8	52.7	88	23	399	2.97	1.33	4.38	6	3.1
June-----	76.6	48.8	62.7	98	33	677	3.02	1.36	4.45	5	0.1
July-----	86.2	55.1	70.7	102	41	951	1.68	0.86	2.40	3	0.0
August-----	84.8	53.3	69.0	100	37	898	1.25	0.39	1.95	3	0.0
September--	72.9	43.2	58.1	95	23	546	1.46	0.51	2.24	3	1.2
October----	60.6	33.6	47.1	83	11	264	1.24	0.58	1.88	3	4.3
November---	44.1	21.8	33.0	71	-9	51	0.69	0.34	0.99	2	8.2
December---	33.6	12.5	23.1	61	-25	11	0.63	0.31	0.91	2	10.8
Yearly:											
Average----	57.7	32.2	45.0	---	---	---	---	---	---	---	---
Extreme----	107	-37	---	103	-30	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,023	16.72	14.03	19.18	36	66.6

\* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

## Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Gillette, Wyoming)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
<b>Last freezing temperature in spring:</b>			
1 year in 10 later than--	May 9	May 23	June 1
2 years in 10 later than--	May 3	May 17	May 27
5 years in 10 later than--	April 22	May 5	May 19
<b>First freezing temperature in fall:</b>			
1 year in 10 earlier than--	Sept. 21	Sept. 12	Sept. 3
2 years in 10 earlier than--	Sept. 27	Sept. 18	Sept. 9
5 years in 10 earlier than--	Oct. 7	Sept. 30	Sept. 20

# General Soil Map Units

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

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified. Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road, building, or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

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

The State Soil Geographic Data Base (STATSGO) for Wyoming is the base for the General Soil Map of Campbell County, Wyoming, Southern Part. Map symbols are the same as for the STATSGO map units. In each major soil group one, two, or three of the major soils or miscellaneous land types that occur within the map unit are listed for the map symbol in the survey area. For more information about the general soil map units refer to the STATSGO map for Wyoming.

## Soils on the Uplands

Areas on alluvial fans, buttes, fan remnants, terraces, hills, plateaus, and ridges of dominantly shallow, moderately deep, and very deep soils

## 53—Cushman-Forkwood-Shingle Association

*Nearly level to moderately steep, shallow to very deep, medium textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 25 percent Cushman and similar soils, 25 percent Forkwood and similar soils, and 15 percent Shingle and similar soils. Slopes are 0 to 30 percent.

The nearly level to moderately sloping Cushman soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part, clay loam in the next part, and loam in the lower part. The substratum is soft shale.

The nearly level to moderately sloping Forkwood soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The moderately sloping and moderately steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

The Cushman and Forkwood soils are used for livestock grazing, hayland and pasture, and wildlife habitat. The Shingle soils are used primarily for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Shingle soil. If the Cushman and Forkwood soils are used for hayland and pasture, the main limitation is low annual precipitation.

This unit provides summer habitat for antelope. Sage grouse leks (breeding areas) also occur in this

unit. The area north of Interstate 90 on the eastern county line is important antelope winter habitat. Important mule deer habitat occurs along the eastern county line south of the Belle Fourche River.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes.

### **114—Forkwood-Terro-Cushman Association**

*Nearly level to moderately sloping, moderately deep to very deep, moderate coarse and medium textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Forkwood and similar soils, 20 percent Terro and similar soils, and 15 percent Cushman and similar soils. Slopes are 0 to 15 percent.

The nearly level to moderately sloping Forkwood soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The gently sloping and moderately sloping Terro soils are on hills and ridges. They are moderately deep over sandstone. The surface soil is fine sandy loam about 3 inches thick. The subsoil is fine sandy loam. The substratum is soft sandstone.

The nearly level to moderately sloping Cushman soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part and clay loam in the lower part. The substratum is soft shale.

The Cushman and Forkwood soils are used for livestock grazing, hayland and pasture, and wildlife habitat. The Terro soils are used primarily for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the Cushman and Forkwood soils are used for hayland and pasture, the main limitation is low annual precipitation.

This unit provides year-round habitat for antelope. Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes and pastures.

### **126—Arwite-Vonalf-Moorhead Association**

*Nearly level to moderately sloping, very deep, moderately coarse, medium, and fine textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Arwite and similar soils, 20 percent Vonalf and similar soils, and 15 percent Moorhead and similar soils. Slopes are 0 to 15 percent.

The nearly level to moderately sloping Arwite soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is fine sandy loam about 5 inches thick. The subsoil is sandy clay loam in the upper part and fine sandy loam in the lower part.

The nearly level to moderately sloping Vonalf soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is fine sandy loam about 6 inches thick. The subsoil is fine sandy loam.

The nearly level to moderately sloping Moorhead soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam or clay loam about 4 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

This unit is used for rangeland, hayland and pasture, nonirrigated cropland, and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If the Arwite and Vonalf soils are used for nonirrigated cropland, the main limitations are low annual precipitation and severe hazard of wind erosion. If the Moorhead soils are used for nonirrigated cropland, the main limitations are low annual precipitation and moderate hazard of wind and water erosion.

All of this unit provides summer habitat for antelope. Important antelope winter habitat occurs southeast of Gillette and near the Belle Fourche River. Important mule deer winter habitat occurs along the eastern county line south of the Belle Fourche River. Several sage grouse leks, black-tailed prairie dog towns, and golden eagle nests occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **128—Renohill-Cushman-Shingle Association**

*Gently sloping to moderately steep, shallow and moderately deep, medium and fine textured soils on hills and ridges*

This unit is about 30 percent Renohill and similar soils, 25 percent Cushman and similar soils, and 15 percent Shingle and similar soils. Slopes are 3 to 30 percent.

The gently sloping and moderately sloping Renohill soils are on hills and ridges. They are moderately deep over shale. The surface soil is clay loam about 4 inches thick. The subsoil is clay loam in the upper part, clay in the next part, and clay loam in the lower part. The substratum is soft shale.

The gently sloping and moderately sloping Cushman soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part, clay loam in the next part, and loam in the lower part. The substratum is soft shale.

The moderately sloping and moderately steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Shingle soils.

All of this unit provides important year-round habitat for antelope and summer habitat for mule deer. Sage grouse leks, golden eagle nests, and prairie dog towns occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pasture, prairies, and nonirrigated wheat fields.

### **130—Forkwood-Ulm-Cushman Association**

*Nearly level to moderately sloping, moderately deep to very deep, medium and fine textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Forkwood and similar soils, 25 percent Ulm and similar soils, and 20 percent Cushman and similar soils. Slopes are 0 to 15 percent.

The nearly level to moderately sloping Forkwood soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The nearly level and gently sloping Ulm soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam or clay loam about 5 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

The nearly level to moderately sloping Cushman soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part, clay loam in the next part, and loam in the lower part. The substratum is soft shale.

This unit is used for livestock grazing, nonirrigated cropland, hayland and pasture, and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If this unit is used for hayland and pasture, the main limitation is low annual precipitation.

All of this unit provides important year-round habitat for antelope and summer habitat for mule deer. Numerous sage grouse leks and golden eagle nests occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbit, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pasture, prairies, and nonirrigated wheat fields.

### **208—Samday-Shingle-Badland Association**

*Moderately sloping to steep, shallow, medium and fine textured soils and Badland on hills and ridges*

This unit is about 25 percent Samday and similar soils, 25 percent Shingle and similar soils, and 15 percent Badland. Slopes are 6 to 60 percent.

The moderately sloping Samday soils are on hills and ridges. They are shallow over shale. The surface soil is clay loam about 2 inches thick. The substratum is silty clay in the upper part and soft shale in the lower part.

The moderately sloping to steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

Badland consists of interbedded sandstone and shale.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing on the Samday and Shingle soils is limited by low annual precipitation, very low available water capacity, and limited rooting depth.

All of this unit provides important year-round habitat for antelope and summer habitat for mule deer.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and Badland.

### **209—Hiland-Ulm-Shingle Association**

*Gently sloping to moderately steep, shallow and very deep, medium and fine textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Hiland and similar soils, 25 percent Ulm and similar soils, and 15 percent Shingle and similar soils. Slopes are 3 to 30 percent.

The gently sloping and moderately sloping Hiland soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is fine sandy loam about 2 inches thick. The subsoil is sandy clay loam in the upper part and sandy loam in the lower part.

The gently sloping Ulm soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam or clay loam about 4 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

The gently sloping to moderately steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Shingle soils.

All of this unit provides summer habitat for antelope and mule deer. The western half of this unit provides important antelope winter habitat. Numerous sage grouse leks, golden eagle nests, and prairie dog towns occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **210—Bidman-Parmleed-Arvada Association**

*Nearly level to moderately sloping, moderately deep and very deep, fine textured soils on alluvial fans, fan remnants, stream terraces, hills, and ridges*

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

The nearly level to moderately sloping Bidman soils are on alluvial fans, fan remnants, stream terraces, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

The gently sloping and moderately sloping Parmleed soils are on hills and ridges. They are moderately deep over shale. The surface soil is loam about 3 inches thick. The subsoil is clay loam in the upper part, clay in the next part, and clay loam in the lower part. The substratum is soft shale.

The nearly level and gently sloping Arvada soils are on alluvial fans, fan remnants, and stream terraces. They are very deep. The surface soil is fine sandy loam about 2 inches thick. The subsoil is very strongly alkaline and strongly saline clay in the upper part and very strongly alkaline and strongly saline silty clay loam and clay loam in the lower part. The substratum is strongly alkaline and strongly saline clay loam.

The Bidman and Parmleed soils are used for livestock grazing, hayland and pasture, and wildlife habitat. Arvada soils are used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing on this unit is limited by low annual precipitation and by the high alkalinity and high salinity of the Arvada soils. If the Bidman and Parmleed soils are used for hayland and pasture, the main limitation is low annual precipitation.

All of this unit provides summer habitat for antelope. The lower slopes of the Hay Creek, Little Thunder Creek, and Coal Creek watersheds in the southeast corner of the survey area provide important antelope winter habitat. Numerous sage grouse leks and an occasional golden eagle nest occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **211—Bowbac-Cushman-Taluce Association**

*Gently sloping to moderately steep, shallow and moderately deep, moderately coarse and medium textured soils on buttes, hills, and ridges*

This unit is about 25 percent Bowbac and similar soils, 25 percent Cushman and similar soils, and 15 percent Taluce and similar soils. Slopes are 3 to 30 percent.

The gently sloping and moderately sloping Bowbac soils are on buttes, hills, and ridges. They are moderately deep over sandstone. The surface soil is fine sandy loam about 3 inches thick. The subsoil is sandy clay loam in the upper part and sandy loam in the lower part. The substratum is slightly hard sandstone.

The gently sloping and moderately sloping Cushman soils are on buttes, hills, and ridges. They are moderately deep over sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part, clay loam in the next part, and loam in the lower part. The substratum is soft shale.

The moderately sloping and moderately steep Taluce soils are on hills and ridges. They are shallow over sandstone. The surface soil is sandy loam about 2 inches thick. The substratum is fine sandy loam in the upper part and soft sandstone in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Taluce soils.

Most of this unit provides summer habitat for mule deer. Areas along the eastern boundary are critical winter and year-round habitat for elk and mule deer.

Numerous golden eagle and prairie falcon nests are present.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and Badland.

### **369—Wibaux-Bidman-Teckla Association**

*Nearly level to steep, very deep, medium and fine textured soils on alluvial fans, fan remnants, hills, ridges, and terraces (fig. 2)*

This unit is about 35 percent Wibaux and similar soils, 20 percent Bidman and similar soils, and 15 percent Teckla and similar soils. Slopes are 0 to 60 percent.

The moderately sloping to steep Wibaux soils are on hills and ridges. They are very deep. The surface soil is channery fine sandy loam about 3 inches thick. The substratum is very channery loam in the upper part and fractured porcelanite in the lower part.

The nearly level to moderately sloping Bidman soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

The nearly level to moderately sloping Teckla soils are on terraces. They are very deep. The surface soil is very fine sandy loam about 10 inches thick. The subsoil is sandy clay loam in the upper part, channery loam in the next part, and very channery loam in the lower part. The substratum is extremely channery sandy loam.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Wibaux soils.

All of this unit provides summer habitat for antelope and mule deer. The area of this map unit north of Little Thunder Creek provides important winter habitat for antelope. Sage grouse leks also occur in this area. The area of this map unit south of Little Thunder Creek includes sage grouse leks and prairie dog towns. The area of this map unit north of Reno Junction provides important winter habitat for antelope and nesting habitat for golden eagles. The area of this map unit north of Interstate 90 provides important winter habitat for antelope.



Figure 2. Typical landforms in General Soil Map Unit 369—Wibaux-Bidman-Teckla. Wibaux soils occur on hills and ridges like those in the background. Bidman and Teckla soils occur on the lesser sloping areas.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### 382—Hilight-Wags-Wibaux Association

*Gently sloping to steep, shallow to very deep, medium and fine textured soils on hills and ridges*

This unit is about 25 percent Hilight and similar soils, 20 percent Wags and similar soils, and 20 percent Wibaux and similar soils. Slopes are 3 to 60 percent.

The gently sloping to steep Hilight soils are on hills and ridges. They are shallow over shale. The surface soil is clay about 2 inches thick. The substratum is clay in the upper part and lignitic shale in the lower part.

The gently sloping to moderately steep Wags soils are on hills and ridges. They are moderately deep over shale. The surface soil is clay loam about 1 inch thick. The substratum is silty clay in the upper part and soft shale in the lower part.

The moderately sloping to steep Wibaux soils are on hills and ridges. They are very deep. The surface soil is channery fine sandy loam about 3 inches thick. The substratum is very channery loam in the upper part and fractured porcelanite in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation, low to very low available water capacity, and by the limited rooting depth of the Hilight and Wibaux soils.

All of this unit provides summer habitat for antelope and mule deer. The Coal Creek watershed provides important antelope winter habitat. An area south of the Belle Fourche River along the eastern

county line provides important mule deer winter habitat. Crucial winter habitat for elk occurs along the county line in the areas northeast of Bacon Creek and south of Little Thunder Creek. Numerous sage grouse leks and golden eagle nests occur throughout the unit. The area of this map unit in the southeast corner of the survey area has a high density of golden eagle nests, prairie dog towns, and prairie falcon nests. This unit is also used by wintering bald eagles.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and ponderosa pine.

### **383—Shingle-Wibaux-Badland Association**

*Moderately sloping to steep, shallow to very deep, medium textured soils and Badland on hills and ridges*

This unit is about 30 percent Shingle and similar soils, 25 percent Wibaux and similar soils, and 15 percent Badland. Slopes are 6 to 60 percent.

The moderately sloping and moderately steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

The moderately sloping to steep Wibaux soils are on hills and ridges. They are very deep. The surface soil is channery fine sandy loam about 3 inches thick. The substratum is very channery loam in the upper part and fractured porcelanite in the lower part.

Badland consists of interbedded sandstone and shale.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing on the Shingle and Wibaux soils is limited by low annual precipitation, very low available water capacity, and limited rooting depth.

All of this unit provides summer habitat for antelope and mule deer. There is a high density of prairie dog towns in this unit. Wintering bald eagles use this area.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and Badland.

### **384—Cambria-Theedle-Kishona Association**

*Gently sloping to moderately steep, moderately deep and very deep, medium textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Cambria and similar soils, 30 percent Theedle and similar soils, and 15 percent Kishona and similar soils. Slopes are 3 to 30 percent.

The gently sloping and moderately sloping Cambria soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The gently sloping to moderately steep Theedle soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part and clay loam in the lower part. The substratum is soft shale.

The gently sloping and moderately sloping Kishona soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 5 inches thick. The subsoil is clay loam.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

All of this unit provides winter and year-round habitat for antelope and summer habitat for mule deer. The lower slopes of Beaver Creek, Pumpkin Creek, Willow Creek, Cottonwood Creek, and upper Dry Fork Creek watersheds provide important mule deer winter habitat. Several sage grouse leks occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **385—Ucross-Deekay-Fairburn Association**

*Nearly level to moderately steep, shallow to very deep, medium textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Ucross and similar soils, 25 percent Deekay and similar soils, and 15 percent Fairburn and similar soils. Slopes are 0 to 30 percent.

The gently sloping to moderately steep Ucross soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 5 inches thick. The subsoil is clay loam. The substratum is soft shale.

The nearly level to moderately sloping Deekay soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 4 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The gently sloping to moderately steep Fairburn soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 4 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

The Ucross and Fairburn soils are used primarily for livestock grazing and wildlife habitat. The Deekay soils are used for livestock grazing, hayland and pasture, and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Fairburn soils. If the Deekay soils are used for hayland and pasture, the main limitation is low annual precipitation.

All of this unit provides summer habitat for antelope and mule deer. The area north of Interstate 90 provides important antelope winter habitat. Sage grouse leks also occur in this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **386—Deekay-Moorhead-Oldwolf Association**

*Nearly level to moderately sloping, moderately deep and very deep, medium and fine textured soils on alluvial fans, fan remnants, hills, and ridges*

This unit is about 30 percent Deekay and similar soils, 25 percent Moorhead and similar soils, and 20 percent Oldwolf and similar soils. Slopes are 0 to 15 percent.

The nearly level to moderately sloping Deekay soils are on alluvial fans, fan remnants, hills, and ridges. They are very deep. The surface soil is loam about 4 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

The nearly level to moderately sloping Moorhead soils are on alluvial fans, fan remnants, hills, and

ridges. They are very deep. The surface soil is clay loam about 4 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

The nearly level to moderately sloping Oldwolf soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 5 inches thick. The subsoil is clay loam in the upper part and loam in the lower part. The substratum is shale.

This unit is used for livestock grazing, hayland and pasture, nonirrigated cropland, and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If this unit is used for hayland and pasture, the main limitation is low annual precipitation. If this unit is used for nonirrigated cropland, the main limitations are low annual precipitation and moderate hazard of wind and water erosion.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and nonirrigated wheat fields.

### **387—Theedle-Shingle-Samday Association**

*Gently sloping to steep, shallow and moderately deep, medium and fine textured soils on hills and ridges*

This unit is about 30 percent Theedle and similar soils, 25 percent Shingle and similar soils, and 20 percent Samday and similar soils. Slopes are 3 to 60 percent.

The gently sloping to moderately steep Theedle soils are on hills and ridges. They are moderately deep over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The subsoil is loam in the upper part and clay loam in the lower part. The substratum is soft shale.

The moderately sloping to steep Shingle soils are on hills and ridges. They are shallow over interbedded sandstone and shale. The surface soil is loam about 2 inches thick. The substratum is loam in the upper part and soft shale in the lower part.

The moderately sloping Samday soils are on hills and ridges. They are shallow over shale. The surface soil is clay loam about 2 inches thick. The substratum is silty clay in the upper part and soft shale in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for

livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Shingle and Samday soils.

All areas of this unit provide year-round habitat for antelope and mule deer. The northern half of the area of this map unit located along the western county line provides important winter habitat for antelope. The low slopes of the Barber Creek, Dead Horse Creek, Beaver Creek, and Pumpkin Creek watersheds provide important mule deer winter habitat. Sage grouse leks occur on this unit.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, and birds common to shrub steppes, pastures, and prairies.

### **398—Ironbutte-Jaywest-Rockybutte Association**

*Nearly level to steep, very deep, medium and fine textured soils on hills, plateaus, and ridges*

This unit is about 35 percent Ironbutte and similar soils, 20 percent Jaywest and similar soils, and 15 percent Rockybutte and similar soils. Slopes are 0 to 60 percent.

The moderately sloping to steep Ironbutte soils are on hills and ridges. They are very deep. The surface soil is channery loam about 4 inches thick. The substratum is very channery loam in the upper part and fractured porcelanite in the lower part.

The nearly level and gently sloping Jaywest soils are on hills and ridges. They are very deep. The surface soil is loam about 7 inches thick. The subsoil is clay loam in the upper part, clay in the next part, and clay loam in the lower part.

The nearly level to moderately sloping Rockybutte soils are on plateaus and ridges. They are very deep. The surface soil is loam about 4 inches thick. The subsoil, in sequence downward, is clay loam, channery clay loam, very channery clay loam, and extremely channery loam. The substratum is fractured porcelanite.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation and by the very low available water capacity and limited rooting depth of the Wibaux soils.

All of this unit provides summer habitat for antelope and mule deer. The area of this map unit north of Little Thunder Creek provides important winter habitat for antelope. Sage grouse leks also

occur in this area. The area of this map unit south of Little Thunder Creek includes sage grouse leks and prairie dog towns. The area of this map unit north of Reno Junction provides important winter habitat for antelope and nesting habitat for golden eagles. The area of this map unit north of Interstate 90 provides important winter habitat for antelope.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, and prairies.

### **399—Lismas-Sabatka-Ironbutte Association**

*Gently sloping to steep, shallow to very deep, medium and fine textured soils on hills and ridges*

This unit is about 25 percent Lismas and similar soils, 20 percent Sabatka and similar soils, and 20 percent Ironbutte and similar soils. Slopes are 3 to 60 percent.

The gently sloping to steep Lismas soils are on hills and ridges. They are shallow over shale. The surface soil is clay loam about 3 inches thick. The substratum is clay in the upper part and shale in the lower part.

The gently sloping to moderately steep Sabatka soils are on hills and ridges. They are moderately deep over shale. The surface soil is clay loam about 3 inches thick. The subsoil is clay. The substratum is clay in the upper part and clayey shale in the lower part.

The moderately sloping to steep Ironbutte soils are on hills and ridges. They are very deep. The surface soil is channery loam about 4 inches thick. The substratum is very channery loam in the upper part and fractured porcelanite in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation, low to very low available water capacity of the soils, and by the limited rooting depth of the Lismas and Ironbutte soils.

All of this unit provides summer habitat for antelope and mule deer. The Coal Creek watershed provides important antelope winter habitat. An area south of the Belle Fourche River along the eastern county line provides important mule deer winter habitat. Crucial winter habitat for elk occurs along the county line in the areas northeast of Bacon Creek and south of Little Thunder Creek. Numerous sage

grouse leks and golden eagle nests occur throughout the unit. The area of this map unit in the southeast corner of the survey area has a high density of golden eagle nests, prairie dog towns, and prairie falcon nests. This unit is also used by wintering bald eagles.

Included in this unit is habitat for species such as white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, prairies, and ponderosa pine.

### Soils on the Lowlands

Areas of dominantly very deep soils on alluvial fans, fan remnants, flood plains, and stream terraces

### 203—Clarkelen-Bidman Association

*Nearly level and gently sloping, very deep, moderately coarse and fine textured soils on alluvial fans, fan remnants, flood plains, and stream terraces*

This unit is about 40 percent Clarkelen and similar soils and 35 percent Bidman and similar soils. Slopes are 0 to 6 percent.

The nearly level Clarkelen soils are on flood plains and stream terraces. They are very deep. The surface soil is very fine sandy loam about 3 inches thick. The substratum is fine sandy loam stratified with sandy loam, very fine sandy loam, and loam in the upper part, and sandy loam stratified with loamy fine sand, fine sandy loam, and very fine sandy loam in the lower part. Clarkelen soils are subject to occasional flooding for very brief periods from April to June.

The nearly level and gently sloping Bidman soils are on alluvial fans, fan remnants, and stream terraces. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay in the upper part and clay loam in the lower part.

This unit is used for livestock grazing and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation.

All of this unit provides summer habitat for antelope and mule deer. The area along Little Thunder Creek provides important winter habitat for antelope and nesting habitat for golden eagles.

Included in this unit is habitat for species such as water shrew, muskrat, beaver, raccoon, mink, white-tailed and black-tailed jackrabbits, thirteen-lined

ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, wetland shrubs and trees, and those associated with water.

### 368—Haverdad-Kishona-Forkwood Association

*Nearly level to moderately sloping, very deep, medium textured soils on alluvial fans, fan remnants, flood plains, and stream terraces*

This unit is about 25 percent Haverdad and similar soils, 25 percent Kishona and similar soils, and 20 percent Forkwood and similar soils. Slopes are 0 to 10 percent.

The nearly level Haverdad soils are on flood plains and stream terraces. They are very deep. The surface soil is loam about 4 inches thick. The substratum is loam stratified with fine sandy loam, very fine sandy loam, sandy clay loam, and silt loam. Haverdad soils are subject to occasional flooding for very brief periods from April to June.

The gently sloping and moderately sloping Kishona soils are on alluvial fans, fan remnants, and stream terraces. They are very deep. The surface soil is loam about 4 inches thick. The subsoil is clay loam.

The nearly level to moderately sloping Forkwood soils are on alluvial fans and fan remnants. They are very deep. The surface soil is loam about 2 inches thick. The subsoil is clay loam in the upper part and loam in the lower part.

This unit is used for livestock grazing, hayland and pasture, and wildlife habitat. The production of vegetation suitable for livestock grazing is limited by low annual precipitation. If this unit is used for hayland and pasture, the main limitation is low annual precipitation.

All of this unit provides summer habitat for antelope and mule deer. The area of this map unit upstream from the confluence of the Belle Fourche River and Dry Creek provides important winter habitat for antelope and nesting habitat for golden eagles.

Included in this unit is habitat for species such as water shrew, muskrat, beaver, raccoon, mink, white-tailed and black-tailed jackrabbits, thirteen-lined ground squirrel, Ord's kangaroo rat, desert cottontail, coyote, red fox, badger, and birds common to shrub steppes, pastures, wetland shrubs and trees, and those associated with water.

## Detailed Soil Map Units

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The map units delineated on the detailed soil maps in Part III 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.

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. 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, however, 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 or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and

consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Arvada, thick surface, very fine sandy loam is a phase of the Arvada series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown

separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Forkwood-Cambria loams, 0 to 6 percent slopes, is an example.

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

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

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of the manuscript gives the acreage and proportionate extent of each map unit. Other tables (See "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

## 100—Aridic Ustorthents, saline, 0 to 4 percent slopes

### Setting

**Elevation:** 4,200 to 4,810 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Aridic Ustorthents and similar soils

Composition: 85 percent  
 Landform: Stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 4 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 6 inches  
 Sodium Affected: Not affected  
**Typical profile:**  
 A—0 to 2 inches; loam

Bw—2 to 6 inches; clay loam

By—6 to 46 inches; stratified loam to clay loam

C—46 to 60 inches; stratified fine sandy loam to clay loam

**Note:** Permeability of Aridic Ustorthents, saline soils is moderately slow. Available water capacity is moderate. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Ziggy: 5 percent

Echeta: 4 percent

Areas of 6 to 15 percent slopes: 3 percent

Poorly drained saline soils: 3 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is moderately suited for stockwater ponds. The main limitation is the moderate potential for seepage losses and the saline soil. Due to the salinity of the soil, the water may not be suitable for livestock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitations for range seeding are the salinity of the subsoil and the hazard of wind erosion. If range seeding is conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity of the subsoil. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 101—Arvada, thick surface very fine sandy loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Arvada and similar soils

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Natric: 15 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 15 inches  
 Sodium Affected: Sodic within 15 inches

#### Typical profile:

E—0 to 7 inches; very fine sandy loam  
 Bt—7 to 15 inches; silty clay loam  
 Btkny—15 to 26 inches; silty clay  
 Bkny—26 to 60 inches; clay loam

**Note:** Permeability of the Arvada, thick surface soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arvada fine sandy loam: 4 percent  
 Bidman: 4 percent  
 Keyner: 4 percent  
 Ulm: 3 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is moderately suited for stockwater ponds. The main limitation is the moderate potential for seepage losses and the saline soil. Due to the salinity of the soil, the water may not be suitable for livestock.

This unit is moderately well suited for mechanical range renovation and range seeding. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. The main limitation for range seeding is the hazard of wind erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface

at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 102—Arvada, thick surface-Arvada-Slickspots complex, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Arvada and similar soils

Composition: 40 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Natric: 15 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None  
 Salt Affected: Saline within 15 inches  
 Sodium Affected: Sodic within 15 inches

#### Typical profile:

E—0 to 7 inches; very fine sandy loam  
 Bt—7 to 15 inches; silty clay loam  
 Btkny—15 to 26 inches; silty clay  
 Bkny—26 to 60 inches; clay

**Note:** Permeability of the Arvada, thick surface soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is severe.

#### Arvada and similar soils

Composition: 30 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Natric: 2 inches

Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 2 inches  
 Sodium Affected: Sodic within 2 inches

**Typical profile:**

E—0 to 2 inches; fine sandy loam

Btn—2 to 9 inches; clay

Btkn—9 to 15 inches; clay

Bkny—15 to 60 inches; silty clay loam

**Note:** Permeability of the Arvada soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is severe.

**Slickspots**

Composition: 10 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: —  
 Depth to Restrictive Feature: None noted  
 Drainage Class: —  
 Parent Material: Alluvium derived from shale  
 Flooding: —  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: No seasonal ponding exists  
 Salt Affected: Saline throughout the soil profile  
 Sodium Affected: Sodic throughout the soil profile

**Note:** 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. Runoff is very high.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bidman: 5 percent  
 Felix, ponded: 5 percent  
 Keyner: 5 percent  
 Ulm: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is moderately suited for stockwater ponds. The main limitation is the moderate potential for seepage losses and the saline soil. Due to the salinity of the soil, the water may not be suitable for livestock.

This unit is moderately well suited for mechanical range renovation and range seeding. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer and the salinity and alkalinity of the Arvada soil and the slickspots. The main limitations for range seeding are the hazard of wind erosion, the salinity and alkalinity of the Arvada soil, and the presence of slickspots. If range seeding is conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity and alkalinity of the Arvada soil. The low annual precipitation should be considered when planning a seeding. The areas of slickspots in this unit support little or no vegetation due to characteristics that severely limit plant growth. Therefore, range seeding and range renovation will not be successful on these areas.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**103—Arwite fine sandy loam, 0 to 6 percent slopes**

**Setting**

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description**

**Arwite and similar soils**

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; fine sandy loam

Bt—5 to 32 inches; sandy clay loam

Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 5 percent

Moskee: 5 percent

Rauzi: 3 percent

Vonalf: 2 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat. A few areas are also used for homesite and urban development.

This unit is poorly suited for stockwater ponds because of the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing helps to maintain the quality of forage.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and the severe hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture

should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips and at right angles to the prevailing wind.

This unit is well suited for urban development. Revegetating disturbed areas around construction sites as soon as possible helps to control wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties

## 104—Arwite fine sandy loam, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Arwite and similar soils

Composition: 80 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; fine sandy loam

Bt—5 to 32 inches; sandy clay loam

Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low to medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Elwop: 6 percent  
 Moskee: 6 percent  
 Vonalf: 6 percent  
 Areas with 15-20 percent slope: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds because of the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties

## 105—Arwite-Elwop fine sandy loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Arwite and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 5 inches; fine sandy loam  
 Bt—5 to 32 inches; sandy clay loam  
 Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

#### Elwop and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 24 inches; sandy clay loam  
 Bk—24 to 35 inches; fine sandy loam  
 Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Elwop soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 4 percent  
 Oldwolf: 4 percent  
 Rauzi: 4 percent  
 Vonalf: 4 percent  
 Xema: 4 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat. A few areas are also used for homesite and urban development.

This unit is poorly suited for stockwater ponds because of the depth to bedrock within the Elwop soil

and the high potential of both soils for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect these soils from excessive wind erosion.

The Arwite soil is well suited and the Elwop soil is moderately well suited for urban development. The main limitation is the depth to bedrock. Revegetating disturbed areas around construction sites as soon as possible helps to control wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 106—Arwite-Elwop fine sandy loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Arwite and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; fine sandy loam  
 Bt—5 to 32 inches; sandy clay loam  
 Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

#### Elwop and similar soils

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 24 inches; sandy clay loam  
 Bk—24 to 35 inches; fine sandy loam  
 Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Elwop soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Oldwolf: 5 percent

Rauzi: 5 percent

Vonalf: 5 percent

Xema: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds because of the depth to bedrock within the Elwop soil

and the high potential of both soils for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 107—Arwite-Vonalf fine sandy loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Arwite and similar soils

Composition: 45 percent  
 Landform: Alluvial fan, hill  
 Landform Element: Foothlope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 5 inches; fine sandy loam

Bt—5 to 32 inches; sandy clay loam

Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

##### Vonalf and similar soils

Composition: 35 percent  
 Landform: Alluvial fan, hill  
 Landform Element: Foothlope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 6 inches; fine sandy loam

Bt—6 to 34 inches; fine sandy loam

Bk—34 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalf soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Elwop: 8 percent

Xema: 5 percent

Areas with 6-10 percent slopes: 2 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds because of the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing and proper hayland management help to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 108—Arwite-Vonalf fine sandy loams, 6 to 15 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Arwite and similar soils

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 5 inches; fine sandy loam

Bt—5 to 32 inches; sandy clay loam

Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Arwite soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

##### Vonalf and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 6 inches; fine sandy loam

Bt—6 to 34 inches; fine sandy loam

Bk—34 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalf soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Elwop: 8 percent

Xema: 5 percent

Areas with 3-6 Percent Slopes: 2 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds because of the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 109—Bidman loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Bidman and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 2 inches; loam

Bt—2 to 28 inches; clay

Bk—28 to 60 inches; clay loam

**Note:** Permeability of the Bidman soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Forkwood: 6 percent

Ulm: 6 percent

Areas with 6 to 10 percent slopes: 5 percent

Felix, ponded: 3 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from excessive water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 110—Bidman loam, loamy substratum, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Bidman and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 4 inches; loam

Bt—4 to 25 inches; clay

Bk—25 to 52 inches; clay loam

2C—52 to 60 inches; sandy clay loam

**Note:** Permeability of the Bidman, loamy substratum soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bidman, loam: 8 percent  
 Ulm: 6 percent  
 Forkwood: 4 percent  
 Felix, ponded: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 111—Bidman-Parmleed loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Bidman and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

E—0 to 2 inches; loam  
 Bt—2 to 28 inches; clay  
 Bk—28 to 60 inches; clay loam

**Note:** Permeability of the Bidman soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Parmleed and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

E—0 to 3 inches; loam  
 Bt—3 to 21 inches; clay  
 Bk—21 to 27 inches; clay loam  
 Cr—27 to 60 inches; bedrock

**Note:** Permeability of the Parmleed soils is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Forkwood: 6 percent  
 Ulm: 6 percent  
 Cushman: 4 percent  
 Felix, ponded: 4 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Bidman soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Parmleed soil is poorly suited for stockwater ponds due to the depth to bedrock.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect these soils from excessive water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 112—Bidman-Parmleed loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Bidman and similar soils

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 2 inches; loam

Bt—2 to 28 inches; clay

Bk—28 to 60 inches; clay loam

**Note:** Permeability of the Bidman soil is slow. Available water capacity is high. Effective

rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Parmleed and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 3 inches; loam

Bt—3 to 21 inches; clay

Bk—21 to 27 inches; clay loam

Cr—27 to 60 inches; bedrock

**Note:** Permeability of the Parmleed soils is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cushman: 5 percent

Forkwood: 5 percent

Worfka: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

The Bidman soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Parmleed soil is poorly suited for stockwater ponds due to the depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitations for range seeding are slope and the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and

tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 113—Bidman-Ulm loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Bidman and similar soils

Composition: 40 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

E—0 to 7 inches; loam  
 Bt—7 to 36 inches; clay loam  
 Bk—36 to 60 inches; clay loam

**Note:** Permeability of the Bidman soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Ulm and similar soils

Composition: 40 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; loam  
 Bt—4 to 30 inches; clay loam  
 Bk—30 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Forkwood: 7 percent  
 Parmleed: 5 percent  
 Renohill: 5 percent  
 Felix, ponded: 3 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Bidman soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Ulm soil is well suited for stockwater ponds.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect these soils from excessive water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 114—Bowbac-Taluze-Badland complex, 3 to 20 percent slopes

### Setting

**Elevation:** 4,400 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Bowbac and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
over residuum weathered from calcareous  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; sandy loam

Bt—3 to 31 inches; sandy clay loam

Bk—31 to 39 inches; sandy loam

Cr—39 to 60 inches; bedrock

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

#### Taluze and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 20 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Somewhat excessively drained

Parent Material: Residuum weathered from  
calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; sandy loam

C—2 to 14 inches; sandy loam

Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Taluze soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

#### Badland

Composition: 15 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: —

Depth to Restrictive Feature: Bedrock (paralithic):  
0 to 0 inches

Drainage Class: —

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Note:** Badland consists of exposures of  
sandstone and sandy shale.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Terro: 5 percent

Turnercrest: 5 percent

Vonalee: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion. The presence of areas of badland is also a limitation.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 115—Bowbac-Worf fine sandy loams, 3 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 6,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Bowbac and similar soils

Composition: 50 percent

Landform: Butte, hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
over residuum weathered from calcareous  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam

Bt—3 to 31 inches; sandy clay loam

Bk—31 to 39 inches; sandy loam

Cr—39 to 60 inches; bedrock

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

#### Worf and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 1 inches; fine sandy loam

Bt—1 to 12 inches; sandy clay loam

Bk—12 to 18 inches; sandy clay loam

Cr—18 to 60 inches; bedrock

**Note:** Permeability of the Worf soil is moderate.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Hiland: 5 percent

Shingle: 5 percent

Taluce: 5 percent

Theedle: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are depth to bedrock and steepness of slope.

The Bowbac soil is moderately well suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of water and wind erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. The Worf soil is poorly suited for mechanical range renovation. Mechanical range renovation may not be economically feasible due to the low potential to increase the amount of forage. The Worf soil is moderately suited for range seeding. The main limitations are the hazard of water and wind erosion and the droughtiness of the soil. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 116—Cambria-Kishona-Zigweid loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Cambria and similar soils

Composition: 40 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 10 inches; clay loam  
 Bk—10 to 60 inches; clay loam

**Note:** Permeability of the Cambria soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Kishona and similar soils

Composition: 30 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bk—2 to 60 inches; loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high.

Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Zigweid and similar soils

Composition: 15 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bw—2 to 13 inches; clay loam  
 Bk—13 to 60 inches; clay loam

**Note:** Permeability of the Zigweid soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cushman: 5 percent  
 Forkwood: 4 percent  
 Ulm: 4 percent  
 Poorly drained soils: 2 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 117—Cambria-Kishona-Zigweid loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Cambria and similar soils

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; loam

Bt—3 to 12 inches; clay loam

Bk—12 to 60 inches; clay loam

**Note:** Permeability of the Cambria soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Kishona and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bk—2 to 60 inches; loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Zigweid and similar soils

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bw—2 to 13 inches; clay loam

Bk—13 to 60 inches; clay loam

**Note:** Permeability of the Zigweid soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cushman: 5 percent

Forkwood: 5 percent

Theedle: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitations are slope and the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and moderately well suited for range

seeding. The main limitation for range seeding is the hazard of erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 118—Clarkelen-Draknab complex, 0 to 3 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Clarkelen and similar soils

Composition: 60 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 3 inches; very fine sandy loam  
 C—3 to 60 inches; stratified loamy fine sand to loam

**Note:** Permeability of the Clarkelen soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

##### Draknab and similar soils

Composition: 25 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Excessively drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 4 inches; sandy loam  
 C1—4 to 28 inches; stratified loamy sand to fine sandy loam  
 C2—28 to 60 inches; stratified sand to sandy loam

**Note:** Permeability of the Draknab soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Boruff: 5 percent  
 Haverdad: 5 percent  
 Kishona: 5 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of wind erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. To reduce the hazard of wind erosion,

adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 119—Clarkelen-Embry fine sandy loams, 0 to 4 percent slopes

#### Setting

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Clarkelen and similar soils

Composition: 55 percent

Landform: Flood plain, stream terrace

Landform Element: None assigned

Slope: 0 to 3 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: Occasional

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam

C—3 to 60 inches; stratified loamy fine sand to loam

**Note:** Permeability of the Clarkelen soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

##### Embry and similar soils

Composition: 25 percent

Landform: Stream terrace

Landform Element: None assigned

Slope: 0 to 4 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam

C—3 to 60 inches; sandy loam

**Note:** Permeability of the Embry soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Gravelly loamy soils: 8 percent

Loamy soils: 8 percent

Poorly drained soils: 4 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 120—Clarkelen-Keeline association, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Clarkelen and similar soils

Composition: 60 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; very fine sandy loam  
 C—3 to 60 inches; stratified loamy fine sand to loam

**Note:** Permeability of the Clarkelen soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through June.

#### Keeline and similar soils

Composition: 25 percent  
 Landform: Stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; sandy loam

C—4 to 60 inches; sandy loam

**Note:** Permeability of the Keeline soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Haverdad: 8 percent

Boruff: 7 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 121—Cushman-Cambria loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Cushman and similar soils

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 19 inches; clay loam  
 Bk—19 to 31 inches; loam  
 Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

### Cambria and similar soils

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone  
 and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 12 inches; clay loam  
 Bk—12 to 60 inches; loam

**Note:** Permeability of the Cambria soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

## Additional Components

Bowbac: 5 percent  
 Forkwood: 5 percent  
 Hiland: 5 percent  
 Kishona: 5 percent

## Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Cushman soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Cambria soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 122—Cushman-Cambria loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Cushman and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; loam

Bt—2 to 23 inches; clay loam

Bk—23 to 30 inches; loam

Cr—30 to 60 inches; bedrock

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

**Cambria and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone  
and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; loam

Bt—2 to 12 inches; clay loam

Bk—12 to 60 inches; loam

**Note:** Permeability of the Cambria soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bowbac: 5 percent

Forkwood: 5 percent

Worf: 5 percent

Zigweid: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

The Cushman soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Cambria soil is moderately well suited for stockwater ponds. The main limitations are slope and the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**123—Cushman-Renohill loams, 6 to 15 percent slopes**

**Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Cushman and similar soils**

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loam

Bt—3 to 13 inches; clay loam

Bk—13 to 25 inches; loam

Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

### **Renohill and similar soils**

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### **Typical profile:**

A—0 to 2 inches; loam  
 Bt—2 to 14 inches; clay  
 Bk—14 to 26 inches; clay loam  
 Cr—26 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### **Additional Components**

Forkwood: 5 percent  
 Ulm: 5 percent  
 Shingle: 4 percent  
 Areas with 3-6 percent slopes: 3 percent  
 Workka: 3 percent

### **Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the

surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## **124—Cushman-Shingle loams, 6 to 15 percent slopes**

### **Setting**

**Elevation:** 4,100 to 5,400 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### **Major Component Description**

#### **Cushman and similar soils**

Composition: 55 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### **Typical profile:**

A—0 to 3 inches; loam  
 Bt—3 to 13 inches; clay loam  
 Bk—13 to 25 inches; loam  
 Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### **Shingle and similar soils**

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 1 inches; loam

C—1 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Theedle: 5 percent

Worf: 4 percent

Areas of 3 to 6 percent slopes: 3 percent

Cambria: 3 percent

Renohill: 3 percent

Samday: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur on this unit in some areas in the Rochelle Hills.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

The Cushman soil is well suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of water and wind erosion. The Shingle soil is poorly suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. Mechanical range renovation on the Shingle soil may not be economically feasible due to low potential to increase the amount of forage. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the

seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 125—Cushman-Terro complex, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Cushman and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loam

Bt—3 to 13 inches; clay loam

Bk—13 to 25 inches; loam

Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Terro and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam  
 Bt—3 to 16 inches; sandy loam  
 Bk—16 to 23 inches; sandy loam  
 Cr—23 to 60 inches; bedrock

**Note:** Permeability of the Terro soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bowbac: 5 percent  
 Hiland: 5 percent  
 Shingle: 5 percent  
 Taluce: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is moderately well suited for range seeding. The main limitation for range seeding is the hazard of water and wind erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding. The Cushman soil is well suited and the Terro soil is moderately well suited for mechanical range renovation. Mechanical range renovation may not be economically feasible on the Terro soil due to the coarse texture of the surface layer.

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**126—Cushman-Theedle loams, 0 to 6 percent slopes****Setting**

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Cushman and similar soils**

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 2 inches; loam  
 Bt—2 to 23 inches; clay loam  
 Bk—23 to 30 inches; loam  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

**Theedle and similar soils**

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; loam

Bk—2 to 28 inches; clay loam

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low to medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Cambria: 5 percent

Kishona: 5 percent

Renohill: 4 percent

Shingle: 4 percent

Areas with 6-10 percent slopes: 2 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**127—Cushman-Theedle loams, 6 to 15 percent slopes**

**Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Cushman and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loam

Bt—3 to 13 inches; clay loam

Bk—13 to 25 inches; loam

Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Theedle and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; loam

Bk—2 to 28 inches; clay loam

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is

severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Kishona: 7 percent  
Shingle: 7 percent  
Cambria: 6 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of water and wind erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 128—Cushman-Worf loams, 3 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Cushman and similar soils

Composition: 50 percent  
Landform: Butte, hill, ridge  
Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; loam

Bt—5 to 25 inches; loam

Bk—25 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Worf and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 10 inches; loam

Bk—10 to 18 inches; loam

Cr—18 to 60 inches; bedrock

**Note:** Permeability of the Worf soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Renohill: 4 percent  
 Theedle: 4 percent  
 Vonalee: 4 percent  
 Taluce: 3 percent  
 Worfka: 3 percent  
 Areas with 0-3 percent slopes: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas in the Rochelle Hills.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

The Cushman soil is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. The Worf soil is poorly suited for mechanical range renovation and moderately well suited for range seeding. The main limitations for range seeding are the hazard of water erosion and the droughtiness of the soil. Mechanical range renovation may not be economically feasible due to low potential to increase the amount of forage. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 129—Decolney-Hiland fine sandy loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Decolney and similar soils

Composition: 50 percent  
 Landform: Alluvial fan, fan remnant

Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 22 inches; sandy clay loam  
 C1—22 to 43 inches; sandy loam  
 C2—43 to 60 inches; sandy loam

**Note:** Permeability of the Decolney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

##### Hiland and similar soils

Composition: 35 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 15 inches; sandy clay loam  
 Bk—15 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Vonalee: 9 percent  
 Bowbac: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Hayland management practices and proper grazing use helps to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 130—Decolney-Hiland fine sandy loams, 6 to 15 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Decolney and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; fine sandy loam

Bt—3 to 22 inches; sandy clay loam

C1—22 to 43 inches; sandy loam

C2—43 to 60 inches; sandy loam

**Note:** Permeability of the Decolney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

##### Hiland and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; fine sandy loam

Bt—3 to 32 inches; sandy clay loam

Bk—32 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Bowbac: 7 percent

Moskee: 6 percent

Vonalee: 5 percent

Areas with 15-20 percent slope: 2 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 131—Deekay loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Deekay and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; loam

Bt—4 to 23 inches; clay loam

Bk—23 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Moorhead: 7 percent

Oshoto: 7 percent

Ziggy: 6 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat (fig. 3). A few areas are also used for homesite and urban development.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and the hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips and at right angles to the prevailing wind. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control water and wind erosion.

This unit is moderately well suited for urban development. The main limitations are the moderate shrink-swell potential and low strength of the soil. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of this soil to support a load.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.



Figure 3. The foreground is a typical area of Deekay loam, 0 to 6 percent slopes, on hills. The background is a typical area of Ironbutte-Fairburn-Mittenbutte complex, 6 to 40 percent slopes.

### 132—Deekay-Moorhead loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Deekay and similar soils

Composition: 50 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; loam

Bt—4 to 24 inches; clay loam

Bk—24 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Moorhead and similar soils

Composition: 35 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 5 inches; loam

Bt—5 to 35 inches; clay

Bk—35 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Jaywest: 5 percent

Oshoto: 5 percent

Recluse: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat. A few areas are also used for homesite and urban development.

The Deekay soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Moorhead soil is well suited for stockwater ponds.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips at right angles to the prevailing wind. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control water and wind erosion.

This unit is moderately well suited for urban development. The main limitations are the moderate shrink-swell potential and low strength of the soils. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of these soils to support a load.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 133—Deekay-Moorhead loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Deekay and similar soils

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; loam

Bt—4 to 24 inches; clay loam

Bk—24 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Moorhead and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; loam

Bt—5 to 35 inches; clay

Bk—35 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Leiter: 5 percent

Oldwolf: 5 percent

Ziggy: 5 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitations are slope and the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 134—Deekay-Oldwolf loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Deekay and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loam

Bt—4 to 24 inches; clay loam

Bk—24 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

### Oldwolf and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loam

Bt—3 to 21 inches; clay loam

Bk—21 to 32 inches; loam

Cr—32 to 60 inches; bedrock

**Note:** Permeability of the Oldwolf soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arwite: 5 percent  
Recluse: 5 percent  
Ucross: 5 percent  
Ziggy: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Deekay soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Oldwolf soil is poorly suited for stockwater ponds. The main limitation is the depth to bedrock.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 135—Deekay-Oldwolf loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Deekay and similar soils

Composition: 50 percent  
Landform: Hill, ridge  
Landform Element: Backslope, footslope  
Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted  
Drainage Class: Well drained  
Parent Material: Alluvium derived from sandstone and shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; loam  
Bt—4 to 24 inches; clay loam  
Bk—24 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Oldwolf and similar soils

Composition: 30 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 6 to 15 percent  
Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
Drainage Class: Well drained  
Parent Material: Alluvium over residuum weathered from sandstone and shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; loam  
Bt—3 to 21 inches; clay loam  
Bk—21 to 32 inches; loam  
Cr—32 to 60 inches; bedrock

**Note:** Permeability of the Oldwolf soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Moorhead: 5 percent  
Recluse: 5 percent  
Ucross: 5 percent  
Ziggy: 5 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Deekay soil is moderately well suited for stockwater ponds. The main limitations are slope and the moderate potential for seepage losses. The Oldwolf soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 136—Deekay-Ziggy loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Deekay and similar soils

Composition: 50 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 4 inches; loam  
 Bt—4 to 24 inches; clay loam  
 Bk—24 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Ziggy and similar soils

Composition: 30 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 5 inches; loam  
 Bw—5 to 14 inches; loam  
 Bk—14 to 60 inches; clay loam

**Note:** Permeability of the Ziggy soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Moorhead: 6 percent  
 Oldwolf: 6 percent  
 Oshoto: 6 percent  
 Areas with 6-10 percent slopes: 2 percent

#### Use and Management

This unit is used primarily as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates and pasture rotation help to keep the pasture in good condition and to protect these soils from excessive wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 137—Echeta clay loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Echeta and similar soils

Composition: 85 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; clay loam

Bw—3 to 15 inches; clay

Bk—15 to 60 inches; clay

**Note:** Permeability of the Echeta soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Moorhead: 9 percent

Cromack: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat. Some areas are also used for homesite and urban development.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to reduce runoff.

This unit is poorly suited for urban development. The main limitations are the high shrink-swell potential and low strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of this soil to support a load.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 138—Echeta-Cromack clay loams, 6 to 15 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Echeta and similar soils

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam  
 Bw—3 to 15 inches; clay  
 Bk—15 to 60 inches; clay

**Note:** Permeability of the Echeta soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Cromack and similar soils**

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 6 inches; clay loam  
 Bw—6 to 14 inches; clay  
 Bk—14 to 29 inches; clay  
 Cr—29 to 60 inches; bedrock

**Note:** Permeability of the Cromack, moist soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Leiter: 5 percent  
 Moorhead: 5 percent  
 Samsil: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

The Echeta soil is moderately well suited for stockwater ponds. The main limitation is slope. The Cromack soil is poorly suited for stockwater ponds. The main limitation is the depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**139—Embry-Orpha complex, 3 to 15 percent slopes****Setting**

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Embry and similar soils**

Composition: 40 percent  
 Landform: Dune  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; fine sandy loam  
 C—4 to 60 inches; sandy loam

**Note:** Permeability of the Embry soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is severe.

**Orpha and similar soils**

Composition: 40 percent  
 Landform: Dune  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Excessively drained  
 Parent Material: Eolian deposits derived from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; fine sand  
 C—4 to 60 inches; fine sand

**Note:** Permeability of the Orpha soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Decolney: 5 percent  
 Julesburg: 5 percent  
 Pugsley: 5 percent  
 Tullock: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

The Orpha soil is poorly suited and the Embry soil is moderately suited for mechanical range renovation and range seeding. The main limitation of this unit for range seeding is the hazard of wind erosion. Mechanical range renovation on this unit may not be economically feasible due to the coarse texture of the surface layer of the soils. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**140—Embry-Taluze sandy loams, 3 to 20 percent slopes****Setting**

**Elevation:** 4,200 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Embry and similar soils**

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 6 inches; sandy loam  
 C—6 to 60 inches; sandy loam  
**Note:** Permeability of the Embry soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

**Taluze and similar soils**

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 20 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Somewhat excessively drained  
 Parent Material: Residuum weathered from sandstone  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; sandy loam

C—4 to 16 inches; sandy loam

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Taluce soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe. This soil is noneffervescent throughout. This does not affect the use and management of this soil.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Shingle: 10 percent

Turnercrest: 10 percent

Julesburg: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Taluce soil and the high potential of both soils for seepage losses.

The Embry soil is moderately well suited and the Taluce soil is poorly suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of water and wind erosion. Mechanical range renovation on this unit may not be economically feasible due to the coarse texture of the surface layer of the soils and the low potential to increase the amount of forage on the Taluce soil. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 141—Emigha loam, 0 to 3 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Emigha and similar soils

Composition: 85 percent

Landform: Stream terrace

Landform Element: None assigned

Slope: 0 to 3 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 1 inches; loam

Bw—1 to 19 inches; silty clay loam

Bk—19 to 60 inches; stratified loam to silty clay loam

**Note:** Permeability of the Emigha soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arvada, thick surface: 4 percent

Keyner: 4 percent

Ulm: 4 percent

Poorly drained soils: 3 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This soil is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering and Soil Properties.

### **142—Emigha, sodic-Arvada, thick surface complex, 0 to 4 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Emigha and similar soils**

Composition: 50 percent  
 Landform: Fan remnant, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 4 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: Rare  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 30 inches  
 Sodium Affected: Sodic within 30 inches

##### **Typical profile:**

A—0 to 3 inches; silty clay loam  
 Bn—3 to 14 inches; silty clay loam  
 Bkn—14 to 60 inches; stratified silt loam to silty clay

**Note:** Permeability of the Emigha, sodic soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium to rapid. The hazard of water and wind erosion is slight. This soil is subject to rare flooding for very brief periods during prolonged, high intensity storms from April through July.

##### **Arvada and similar soils**

Composition: 30 percent  
 Landform: Fan remnant, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 4 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 30 inches  
 Sodium Affected: Sodic within 30 inches

##### **Typical profile:**

E—0 to 3 inches; loam  
 Bt—3 to 12 inches; silty clay loam  
 Btkn—12 to 30 inches; silty clay  
 Bkny—30 to 46 inches; silty clay loam  
 C—46 to 60 inches; silty clay loam

**Note:** Permeability of the Arvada, thick surface soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Emigha, nonsodic: 7 percent  
 Keyner: 7 percent  
 Clayey saline soils: 3 percent  
 Loamy saline soils: 3 percent

#### **Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is moderately suited for stockwater ponds. The main limitation is the saline soil. Due to the salinity of the soil, the water may not be suitable for livestock.

The Emigha soil is poorly suited for mechanical range renovation and range seeding. The main limitation is the salinity and alkalinity of the soil. The Arvada soil is well suited for mechanical range renovation and range seeding. If range seeding is conducted on the Emigha soil, seeding rates may need to be increased and plant species carefully selected because of the

salinity and alkalinity of the soils. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding. Mechanical range renovation may not be economically feasible on the Emigha soil due to low potential to increase the amount of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 143—Felix clay, ponded, 0 to 2 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 19 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Felix and similar soils

Composition: 90 percent

Landform: Depression, playa

Landform Element: None assigned

Slope: 0 to 2 percent

Depth to Restrictive Feature: None noted

Drainage Class: Poorly drained

Parent Material: Alluvium derived from shale

Flooding: None

Water Table: Seasonal water table exists. See

Water Features Table for additional information

Ponding: Occasional

##### Typical profile:

A—0 to 5 inches; clay

Bss—5 to 30 inches; clay

By—30 to 50 inches; clay

Bky—50 to 60 inches; clay

**Note:** Permeability of the Felix soil is very slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to frequent ponding up to 1.5 feet of water for brief to very long periods from March through July.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Bidman: 2 percent

Heldt: 2 percent

Jaywest: 2 percent

Moorhead: 2 percent

Ulm: 2 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is well suited for stockwater ponds.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitation is the clayey surface layer and the frequency of ponding. This soil is very hard when dry. If it is worked even when slightly wet, a cloddy seedbed will be produced.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties

### 144—Forkwood loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Forkwood and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 23 inches; clay loam

Bk—23 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cambria: 7 percent  
Ulm: 7 percent  
Wytote: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper grazing use helps to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

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

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Forkwood and similar soils

Composition: 45 percent  
Landform: Alluvial fan, fan remnant

Landform Element: None assigned  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: None noted  
Drainage Class: Well drained  
Parent Material: Alluvium derived from sandstone and shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; loam  
Bt—3 to 14 inches; clay loam  
Bk—14 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Cambria and similar soils

Composition: 35 percent  
Landform: Alluvial fan, fan remnant  
Landform Element: None assigned  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: None noted  
Drainage Class: Well drained  
Parent Material: Alluvium derived from sandstone and shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
Bt—2 to 12 inches; clay loam  
Bk—12 to 60 inches; loam

**Note:** Permeability of the Cambria soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Areas with 6-10 percent slopes: 4 percent  
Cushman: 4 percent  
Ulm: 4 percent  
Wytote: 4 percent  
Zigweid: 4 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper grazing use helps to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering and Soil Properties.

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

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Forkwood and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 2 inches; loam  
 Bt—2 to 23 inches; clay loam  
 Bk—23 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Cushman and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 23 inches; clay loam  
 Bk—23 to 30 inches; loam  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Cambria: 5 percent  
 Theedle: 5 percent  
 Hiland: 4 percent  
 Bowbac: 3 percent  
 Frequently ponded loamy soils: 2 percent  
 Frequently ponded clayey soils: 1 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Forkwood soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Cushman soil is poorly suited for stockwater ponds. The main limitation is the depth to bedrock.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 147—Forkwood-Cushman loams, 6 to 15 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Forkwood and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 23 inches; clay loam  
 Bk—23 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### Cushman and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 23 inches; clay loam  
 Bk—23 to 30 inches; loam  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Cushman soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Cambria: 5 percent  
 Theedle: 5 percent  
 Ulm: 5 percent  
 Zigweid: 5 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Forkwood soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Cushman soil is poorly suited for stockwater ponds. The main limitation is the depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be

along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 148—Forkwood-Ulm loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Forkwood and similar soils

Composition: 50 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 23 inches; clay loam

Bk—23 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Ulm and similar soils

Composition: 35 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 22 inches; clay

Bk—22 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bidman: 4 percent

Cambria: 4 percent

Wytote: 4 percent

Felix, ponded: 3 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Forkwood soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Ulm soil is well suited for stockwater ponds.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing helps to maintain the quality of forage. Proper grazing use helps to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 149—Forkwood-Ulm loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Forkwood and similar soils

Composition: 55 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 23 inches; clay loam

Bk—23 to 60 inches; loam

**Note:** Permeability of the Forkwood soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Ulm and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bt—2 to 22 inches; clay loam

Bk—22 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective

rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is moderate to severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cambria: 5 percent

Cushman: 5 percent

Reno Hill: 5 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds due to the moderate potential of the Forkwood soil for seepage losses and the steepness of slope of this unit.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 150—Gateson-Taluze-Turnercrest complex, 6 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Gateson and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Backslope, summit

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
over residuum weathered from sandstone and  
shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

Oi—0 to 2 inches; slightly decomposed plant  
material

E—2 to 6 inches; loamy fine sand

EB—6 to 11 inches; stratified loamy fine sand to  
sandy clay loam

Bt—11 to 30 inches; sandy clay loam

Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Gateson soil is  
moderate. Available water capacity is low.  
Effective rooting depth is 20 to 40 inches.  
Runoff is very high. The hazard of water and  
wind erosion is severe.

**Taluce and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Somewhat excessively drained

Parent Material: Residuum weathered from  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam

C—3 to 16 inches; sandy loam

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Taluce soil is  
moderately rapid. Available water capacity is  
very low. Effective rooting depth is 10 to 20  
inches. Runoff is very high. The hazard of  
water and wind erosion is severe. This soil is  
noneffervescent throughout. This does not  
affect the use and management of this soil.

**Turnercrest and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, summit

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
and/or residuum weathered from sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loamy fine sand

C—4 to 32 inches; sandy loam

Cr—32 to 60 inches; bedrock

**Note:** Permeability of the Turnercrest soil is  
moderately rapid. Available water capacity is  
low. Effective rooting depth is 20 to 40 inches.  
Runoff is low. The hazard of water erosion is  
moderate. The hazard of wind erosion is  
severe. This soil is noneffervescent throughout.  
This does not affect the use and management  
of this soil.

Typical soil descriptions with range in characteristics  
are included, in alphabetical order, in the section Soil  
Series and Their Morphology.

**Additional Components**

Badland: 5 percent

Decolney: 5 percent

Embry: 5 percent

Orpha: 5 percent

**Use and Management**

This unit is used for wildlife habitat and rangeland.

This unit is poorly suited for stockwater ponds,  
mechanical range renovation, and range seeding.  
The main limitations are depth to bedrock, steepness  
of slope, and the hazard of water and wind erosion.

The Gateson soil is well suited to the production of  
ponderosa pine. The main concerns in producing and  
harvesting timber are the severe hazards of water  
and wind erosion and steepness of slope. The site  
index for ponderosa pine is about 40. Management  
that minimizes the risk of water and wind erosion is  
essential in harvesting timber. Conventional methods  
of harvesting trees can be used in the more gently  
sloping areas but are difficult to use in the steeper  
areas.

For general and detailed information about managing  
this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 151—Haverdad loam, 0 to 3 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Haverdad and similar soils

Composition: 80 percent

Landform: Flood plain, stream terrace

Landform Element: None assigned

Slope: 0 to 3 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: Occasional

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; loam

C—4 to 60 inches; stratified fine sandy loam to silt loam

**Note:** Permeability of the Haverdad soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Boruff: 5 percent

Clarkelen: 5 percent

Draknab: 5 percent

Kishona: 5 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 152—Haverdad-Clarkelen complex, 0 to 4 percent slopes

#### Setting

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Haverdad and similar soils

Composition: 45 percent

Landform: Flood plain, stream terrace

Landform Element: None assigned

Slope: 0 to 4 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: Occasional

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; loam

C—3 to 60 inches; stratified fine sandy loam to clay loam

**Note:** Permeability of the Haverdad soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

### Clarkelen and similar soils

Composition: 35 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 4 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 C—4 to 60 inches; stratified loamy fine sand to loam

**Note:** Permeability of the Clarkelen soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Boruff: 5 percent  
 Draknab: 5 percent  
 Keeline: 5 percent  
 Kishona: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

The Haverdad soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Clarkelen soil is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 153—Haverdad-Kishona association, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Haverdad and similar soils

Composition: 45 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 7 inches; clay loam

C—7 to 60 inches; stratified very fine sandy loam to clay loam

**Note:** Permeability of the Haverdad soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to occasional flooding for very brief periods during prolonged, high intensity storms from April through July.

**Kishona and similar soils**

Composition: 35 percent

Landform: Stream terrace

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam

Bk—3 to 60 inches; clay loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Clarkelen: 7 percent

Keeline: 7 percent

Boruff: 6 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and moderately well suited for range

seeding. The main limitation is the hazard of wind erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**154—Heldt clay loam, 0 to 6 percent slopes****Setting**

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description****Heldt and similar soils**

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam

Bw—3 to 25 inches; clay

Bk—25 to 60 inches; silty clay

**Note:** Permeability of the Heldt soil is slow.

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Ulm: 7 percent

Bidman: 4 percent

Absted: 3 percent  
 Nuncho: 2 percent  
 Platmak: 2 percent  
 Wyarno: 2 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 155—Heldt-Bidman complex, saline, 0 to 3 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 17 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Heldt and similar soils

Composition: 45 percent  
 Landform: Fan remnant, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: Frequent  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 2 inches  
 Sodium Affected: Not affected

##### Typical profile:

A—0 to 2 inches; clay loam  
 Bny—2 to 22 inches; clay  
 Bkny—22 to 60 inches; clay

**Note:** Permeability of the Heldt, saline soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to frequent ponding up to 1.5 feet of water for brief to very long periods from March through July.

##### Bidman and similar soils

Composition: 35 percent  
 Landform: Fan remnant, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: Frequent  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 4 inches  
 Sodium Affected: Not affected

##### Typical profile:

E—0 to 4 inches; loam  
 Btn—4 to 13 inches; clay  
 Bkny—13 to 60 inches; clay loam

**Note:** Permeability of the Bidman, saline soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate. This soil is subject to rare to frequent ponding up to 1.5 feet of water for brief to very long periods from March through July.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Felix, ponded: 7 percent  
 Forkwood: 5 percent  
 Slickspots: 5 percent  
 Ulm: 3 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is well suited for stockwater ponds.

This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the moderate salinity in the subsoil of these soils. The hazard of wind erosion is also a limitation for range seeding. If range seeding is conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity of the soils. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

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

#### **Setting**

**Elevation:** 4,100 to 5,300 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Hiland and similar soils**

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### **Typical profile:**

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 19 inches; sandy clay loam  
 Bk—19 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Forkwood: 4 percent

Moskee: 4 percent

Vonalee: 4 percent

Maysdorf: 3 percent

#### **Use and Management**

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

If this unit is used for hayland and pasture, the main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

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

#### **Setting**

**Elevation:** 4,100 to 5,300 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Hiland and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 24 inches; sandy clay loam  
 Bk—24 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

### Bowbac and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 31 inches; sandy clay loam  
 Bk—31 to 39 inches; sandy loam  
 Cr—39 to 60 inches; bedrock

**Note:** Permeability of the Bowbac soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

## Additional Components

Cushman: 5 percent  
 Forkwood: 5 percent  
 Terro: 5 percent  
 Vonalee: 5 percent

## Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses. The depth to bedrock within the Bowbac soil is also a limitation.

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

If this unit is used for nonirrigated hayland and pasture, the main limitation is low annual precipitation. Using management practices such as rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 158—Hiland-Bowbac fine sandy loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,300 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Hiland and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 24 inches; sandy clay loam  
 Bk—24 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

### Bowbac and similar soils

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 31 inches; sandy clay loam  
 Bk—31 to 39 inches; sandy loam  
 Cr—39 to 60 inches; bedrock

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

## Additional Components

Decolney: 4 percent  
 Maysdorf: 4 percent  
 Terro: 4 percent  
 Vonalee: 4 percent  
 Worf: 4 percent

## Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur on this unit in some areas in the Rochelle Hills.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses. The depth to bedrock within the Bowbac soil is also a limitation.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 159—Hiland-Vonalee fine sandy loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Hiland and similar soils

Composition: 50 percent  
 Landform: Alluvial fan, hill  
 Landform Element: Footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; fine sandy loam

Bt—3 to 23 inches; sandy clay loam

Bk—23 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

**Vonalee and similar soils**

Composition: 35 percent

Landform: Alluvial fan, hill

Landform Element: Foothlope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; fine sandy loam

Bt—5 to 16 inches; sandy loam

Bk—16 to 60 inches; sandy loam

**Note:** Permeability of the Vonalee soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Decolney: 7 percent

Bowbac: 4 percent

Terro: 4 percent

**Use and Management**

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

If this unit is used for hayland and pasture, the main limitation is low annual precipitation. Using grazing and hayland management practices such as proper grazing use helps to maintain the quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**160—Hiland-Vonalee fine sandy loams, 6 to 15 percent slopes**

**Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Hiland and similar soils**

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, foothlope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; fine sandy loam

Bt—3 to 23 inches; sandy clay loam

Bk—23 to 60 inches; sandy loam

**Note:** Permeability of the Hiland soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

**Vonalee and similar soils**

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits  
 derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 5 inches; fine sandy loam  
 Bt—5 to 24 inches; sandy loam  
 Bk—24 to 60 inches; sandy loam

**Note:** Permeability of the Vonalee soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bowbac: 4 percent  
 Decolney: 4 percent  
 Terro: 4 percent  
 Areas with 3-6 percent slopes: 3 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**161—Hilight-Taluze, cool-Wags complex, 6 to 40 percent slopes****Setting**

**Elevation:** 4,100 to 4,900 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Hilight and similar soils**

Composition: 40 percent  
 Landform: Break, hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from acid  
 shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 2 inches; clay loam  
 C—2 to 14 inches; clay  
 Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Hilight is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Taluze and similar soils**

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Somewhat excessively drained  
 Parent Material: Residuum weathered from  
 sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; sandy loam

C—4 to 18 inches; sandy loam

Cr—18 to 60 inches; bedrock

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

**Wags and similar soils**

Composition: 15 percent

Landform: Hill, ridge

Landform Element: Backslope, summit

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from acid shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; clay

C—4 to 34 inches; clay

Cr—34 to 60 inches; bedrock

**Note:** Permeability of the Wags soil is slow.

Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is very high. The hazard of water erosion is severe.

The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Moderately deep loamy soils: 8 percent

Badland: 7 percent

Gullies with 40-80% slopes: 5 percent

**Use and Management**

This unit is used for wildlife habitat and rangeland.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**162—Lismas-Mittenbutte, cool-Sabatka complex, 6 to 40 percent slopes****Setting****Elevation:** 4,100 to 4,800 feet**Mean annual precipitation:** 15 to 17 inches**Frost-free period:** 105 to 130 days**Major Component Description****Lismas and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from acid  
shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam

Cy—3 to 16 inches; clay

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Lismas soil is very slow.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe.

The hazard of wind erosion is moderate.

**Mittenbutte and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; fine sandy loam

C—4 to 18 inches; fine sandy loam

Cr—18 to 60 inches; bedrock

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

**Sabatka and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, summit

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from acid shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam

Bw—3 to 19 inches; clay

C—19 to 30 inches; clay

Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Sabatka soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Moderately deep loamy soils: 8 percent

Badland: 7 percent

Gullies with 40-80% slopes: 5 percent

**Use and Management**

This unit is used for wildlife habitat and rangeland. Ponderosa pine and Rocky Mountain juniper invade this mapping unit. Canopy cover is less than 15 percent.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding.

The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**163—Hilight-Wags-Badland complex, 3 to 45 percent slopes****Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description****Hilight and similar soils**

Composition: 35 percent

Landform: Hill, ridge, break

Landform Element: Summit, shoulder

Slope: 3 to 45 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from acid  
shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; clay

C—2 to 12 inches; clay

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Hilight soil is slow.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe.

The hazard of wind erosion is moderate.

**Wags and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from acid shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 1 inches; channery clay loam

C—1 to 23 inches; silty clay

Cr—23 to 60 inches; bedrock

**Note:** Permeability of the Wags soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Badland**

Composition: 10 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: —  
 Depth to Restrictive Feature: Bedrock (paralithic): 0 to 0 inches  
 Drainage Class: —  
 Parent Material: Residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Note:** Badland consists of exposures of interbedded, noneffervescent shale and sandstone.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Samday: 6 percent  
 Savageton: 6 percent  
 Shingle: 6 percent  
 Taluce: 6 percent  
 Poorly drained clayey soils: 1 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**164—Lismas-Sabatka-Badland complex, 3 to 45 percent slopes**

**Setting**

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Lismas and similar soils**

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 45 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from acid shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; clay loam  
 Cy—3 to 16 inches; clay  
 Cr—16 to 60 inches; bedrock  
**Note:** Permeability of the Lismas soil is very slow. Available water capacity is very low. Effective rooting depth is 10 to 40 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Sabatka and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from acid shale  
 Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; clay loam

Bw—3 to 19 inches; clay

C—19 to 30 inches; clay

Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Sabatka soil is very slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Badland**

Composition: 10 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: —

Depth to Restrictive Feature: Bedrock (paralithic): 0 to 0 inches

Drainage Class: —

Parent Material: Residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Note:** Badland consists of exposures of interbedded, noneffervescent shale and sandstone.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Cromack: 7 percent

Mittenbutte: 7 percent

Fairburn: 5 percent

Ironbutte: 5 percent

Poorly drained clayey soils: 1 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat. Ponderosa pine and Rocky Mountain juniper invade this mapping unit, canopy cover is less than 15 percent.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding.

The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**165—Jayem fine sandy loam, 6 to 20 percent slopes**

**Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Jayem and similar soils**

Composition: 80 percent

Landform: Hill

Landform Element: Backslope, footslope

Slope: 6 to 20 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Eolian deposits derived from sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 17 inches; fine sandy loam

Bw—17 to 31 inches; fine sandy loam

C—31 to 60 inches; fine sandy loam

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Julesburg: 7 percent

Turnercrest: 6 percent

Orpha: 5 percent

Areas with 20-30 percent slope: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 166—Jaywest loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Jaywest and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

E—0 to 7 inches; loam

Bt—7 to 36 inches; clay

Bk—36 to 60 inches; clay loam

**Note:** Permeability of the Jaywest soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Deekay: 5 percent

Gullies: 5 percent

Moorhead: 5 percent

Platmak: 3 percent

Areas of 6-10 percent slopes: 2 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat.

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

If this unit is used for nonirrigated hayland and pasture, the main limitation is low annual precipitation. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

If this unit is used for nonirrigated cropland, the main limitations are low annual precipitation and the moderate hazard of water and wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips at right angles to the prevailing wind. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 167—Jaywest-Moorhead loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Jaywest and similar soils

Composition: 40 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 7 inches; loam

Bt—7 to 36 inches; clay

Bk—36 to 60 inches; clay loam

**Note:** Permeability of the Jaywest soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Moorhead and similar soils

Composition: 40 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; loam

Bt—5 to 35 inches; clay

Bk—35 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective

rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight to moderate. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 5 percent

Leiter: 5 percent

Platmak: 5 percent

Spottedhorse: 5 percent

### Use and Management

This unit is used as rangeland, hayland and pasture, nonirrigated cropland, and wildlife habitat.

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

If this unit is used for hayland and pasture, the main limitation is low annual precipitation. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

If this unit is used for nonirrigated cropland, the main limitations are low annual precipitation and moderate hazard of water and wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips at right angles to the prevailing wind. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control water and wind erosion. A tillage pan forms easily if these soils are tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 168—Jaywest-Spottedhorse loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Jaywest and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 7 inches; loam

Bt—7 to 36 inches; clay

Bk—36 to 60 inches; clay loam

**Note:** Permeability of the Jaywest soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Spottedhorse and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

E—0 to 4 inches; loam

Bt—4 to 27 inches; clay

Bk—27 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Spottedhorse soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 7 percent

Moorhead: 7 percent

Oldwolf: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Jaywest soil is well suited and the Spottedhorse soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

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

If this unit is used for nonirrigated hayland and pasture, the main limitation is low annual precipitation. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 169—Julesburg fine sandy loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,200 to 5,000 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Julesburg and similar soils

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 10 inches; fine sandy loam  
 Bt—10 to 32 inches; fine sandy loam  
 C—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Julesburg soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Decolney: 5 percent  
 Moskee: 5 percent  
 Vonalf: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

If this unit is used for nonirrigated hayland and pasture, the main limitation is low annual precipitation. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 170—Keeline-Tullock loamy sands, 6 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Keeline and similar soils

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 20 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 6 inches; loamy sand  
 C—6 to 60 inches; fine sandy loam

**Note:** Permeability of the Keeline soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

### Tullock and similar soils

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Excessively drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loamy sand

C—4 to 28 inches; loamy sand

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Tullock soil is rapid.

Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Orpha: 5 percent

Terro: 5 percent

Taluca: 4 percent

Vonalee: 3 percent

Badland: 2 percent

Blowouts: 1 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses. The depth to bedrock within the Tullock soil is also a limitation.

This unit is poorly suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 171—Keeline-Tullock-Niobrara, dry complex, 3 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Keeline and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 3 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; sandy loam

C—4 to 60 inches; sandy loam

**Note:** Permeability of the Keeline soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

#### Tullock and similar soils

Composition: 25 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Excessively drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loamy sand

C—4 to 22 inches; loamy sand

Cr—22 to 60 inches; bedrock

**Note:** Permeability of the Tullock soil is rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very low. The hazard of water and wind erosion is severe.

#### Niobrara and similar soils

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Excessively drained  
 Parent Material: Residuum weathered from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; loamy sand  
 C—3 to 12 inches; sand  
 Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Niobrara soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Turnercrest: 9 percent  
 Orpha: 8 percent  
 Badland: 7 percent  
 Blowouts: 1 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Tullock and Niobrara soils and the high potential of all the soils for seepage losses.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of water and wind erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 172—Keyner fine sandy loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

#### Keyner and similar soils

Composition: 80 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Natric: 12 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
 Salt Affected: Saline within 12 inches  
 Sodium Affected: Sodic within 12 inches

#### Typical profile:

E—0 to 4 inches; fine sandy loam  
 Bt—4 to 12 inches; clay loam  
 Btn—12 to 20 inches; sandy clay loam  
 Btkn—20 to 26 inches; sandy clay loam  
 Bkn—26 to 60 inches; sandy clay loam

**Note:** Permeability of the Keyner soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more for salt-tolerant plants. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Arvada, thick surface: 5 percent  
 Emigha, sodic: 5 percent  
 Forkwood: 5 percent  
 Zigweid: 5 percent

## Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is well suited for stockwater ponds.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitation is the salinity and alkalinity of the subsoil. The hazard of wind erosion is also a concern for range seeding. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. If range seeding is conducted, seeding rates may need to be increased and plant species carefully selected because of the salinity and alkalinity of the subsoil. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 173—Lawver-Teckla-Wibaux complex, 0 to 6 percent slopes

### Setting

**Elevation:** 4,400 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Lawver and similar soils

Composition: 30 percent  
Landform: Mesa, terrace  
Landform Element: Summit, shoulder  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches  
Drainage Class: Well drained  
Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

#### Typical profile:

E—0 to 4 inches; loam  
Bt—4 to 20 inches; clay loam  
2Btk—20 to 27 inches; channery clay loam  
2Bk—27 to 38 inches; very channery clay loam  
3C—38 to 60 inches; extremely channery sandy loam

**Note:** Permeability of the Lawver soil is slow in the subsoil and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Teckla and similar soils

Composition: 30 percent  
Landform: Mesa, terrace  
Landform Element: Summit, shoulder  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches  
Drainage Class: Well drained  
Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

#### Typical profile:

A—0 to 10 inches; very fine sandy loam  
Bt—10 to 23 inches; sandy clay loam  
2Bt—23 to 31 inches; channery loam  
2Bk—31 to 45 inches; very channery loam  
3C—45 to 60 inches; extremely channery sandy loam

**Note:** Permeability of the Teckla soil is moderate in the upper part and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

#### Wibaux and similar soils

Composition: 20 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
Drainage Class: Well drained  
Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite  
Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; very channery loam

C—3 to 13 inches; very channery loam

2C—13 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux soil is moderately rapid in the surface and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of the porcelanite. Runoff is very low. The hazard of water and wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Lawver-like: 7 percent

Teckla-like: 7 percent

Areas with 6-10 percent slopes: 6 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

The Lawver soil is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of wind erosion. The Wibaux soil is poorly suited for mechanical range renovation and range seeding. The main limitation is the high amount of rock fragments in the surface layer. The Teckla soil is moderately well suited for mechanical range renovation and range seeding. Mechanical range renovation may not be economically feasible on the Teckla soil due to the coarse texture of the surface layer. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**174—Brislawn-Rockybutte-Ironbutte complex, 0 to 10 percent slopes**

**Setting**

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Brislawn and similar soils**

Composition: 30 percent

Landform: Plateau, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

E—0 to 6 inches; loam

Bt—6 to 21 inches; clay

2Btk—21 to 31 inches; channery clay loam

2Bk—31 to 37 inches; very channery clay loam

3C—37 to 60 inches; fragmental material

**Note:** Permeability of the Brislawn soil is slow in the subsoil and very rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

**Rockybutte and similar soils**

Composition: 30 percent

Landform: Plateau, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; loam

Bt—5 to 23 inches; clay loam

2Bk—23 to 38 inches; extremely channery loam

3C—38 to 60 inches; fragmental material

**Note:** Permeability of the Rockybutte soil is moderate in the surface and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of the porcelanite. Runoff is low. The hazard of water and wind erosion is slight.

**Ironbutte and similar soils**

Composition: 20 percent

Landform: Ridge

Landform Element: Summit, shoulder

Slope: 0 to 10 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or colluvium derived from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; channery loam

C—4 to 12 inches; very channery loam

2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte soil is moderate in the surface soil and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of the porcelanite. Runoff is very low. The hazard of water and wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Brislawn-like: 10 percent

Sandy soils: 10 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

The Brislawn and Rockybutte soils are well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of wind erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The Ironbutte soil is poorly suited for mechanical range renovation and range seeding. The main limitation is the high amount of rock fragments in the surface layer. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**175—Lawver-Wibaux complex, 6 to 30 percent slopes****Setting**

**Elevation:** 4,200 to 5,100 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description****Lawver and similar soils**

Composition: 40 percent

Landform: Terrace

Landform Element: None assigned

Slope: 6 to 15 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

E—0 to 4 inches; loam

Bt—4 to 20 inches; clay loam

2Btk—20 to 27 inches; channery clay loam

2Bk—27 to 38 inches; very channery clay loam

3C—38 to 60 inches; extremely channery sandy loam

**Note:** Permeability of the Lawver soil is slow in the subsoil and rapid in the substratum.

Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Wibaux and similar soils

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: None assigned  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; very channery loam  
 C—3 to 13 inches; very channery loam  
 2C—13 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux soil is moderate in the surface and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of the porcelanite. Runoff is low. The hazard of water and wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Teckla: 7 percent  
 Wibaux, thin solum: 7 percent  
 Badland: 6 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the high potential for seepage losses and slope.

The Lawver soil is moderately well suited for mechanical range renovation and range seeding. The main limitations are slope and the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the

contour of the slope. The Wibaux soil is poorly suited for mechanical range renovation and range seeding. The main limitations are the high amount of rock fragments in the surface layer and slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 176—Leiter-Cromack clay loams, 3 to 15 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Leiter and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, summit  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; clay loam  
 Bt—3 to 22 inches; clay  
 Bk—22 to 33 inches; clay loam  
 Cr—33 to 60 inches; bedrock

**Note:** Permeability of the Leiter soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### Cromack and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 6 inches; clay loam

Bw—6 to 14 inches; clay

Bk—14 to 29 inches; clay

Cr—29 to 60 inches; bedrock

**Note:** Permeability of the Cromack soil is slow.  
Available water capacity is low. Effective  
rooting depth is 20 to 40 inches. Runoff is high.  
The hazard of water and wind erosion is  
moderate.

Typical soil descriptions with range in characteristics  
are included, in alphabetical order, in the section Soil  
Series and Their Morphology.

**Additional Components**

Fairburn: 5 percent

Samsil: 5 percent

Moorhead: 4 percent

Ucross: 4 percent

Areas with 0-3 percent slope: 2 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The  
main limitation is depth to bedrock.

This unit is well suited for mechanical range  
renovation and moderately well suited for range  
seeding. The main limitation is the hazard of water  
and wind erosion. To reduce the hazard of erosion,  
adequate residue must be maintained on the surface  
at all times until the seeding is established. Tilled  
areas must remain narrow and at right angles to the  
wind. If practical, renovation and tillage for seeding  
should be along the contour of the slope. The low  
annual precipitation should be considered when  
planning a seeding.

For general and detailed information about managing  
this map unit, see the following sections in Part II of  
this publication: Agronomy, Range, Recreation,  
Wildlife Habitat, Engineering, and Soil Properties.

**177—Maysdorf fine sandy loam, 0 to 6  
percent slopes**

**Setting**

**Elevation:** 4,100 to 5,100 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Maysdorf and similar soils**

Composition: 75 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; fine sandy loam

Bt—3 to 33 inches; sandy clay loam

Bk—33 to 60 inches; fine sandy loam

**Note:** Permeability of the Maysdorf soil is  
moderate. Available water capacity is high.  
Effective rooting depth is 60 inches or more.  
Runoff is low. The hazard of water erosion is  
slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics  
are included, in alphabetical order, in the section Soil  
Series and Their Morphology.

**Additional Components**

Decolney: 7 percent

Hiland: 5 percent

Forkwood: 4 percent

Moskee: 3 percent

Pugsley: 3 percent

Vonalee: 3 percent

**Use and Management**

This unit is used as rangeland, nonirrigated hayland  
and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The  
main limitation is the high potential for seepage  
losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **178—Maysdorf sandy clay loam, 0 to 6 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Maysdorf and similar soils**

Composition: 75 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### **Typical profile:**

A—0 to 5 inches; sandy clay loam

Bt—5 to 26 inches; sandy clay loam

Bk—26 to 60 inches; fine sandy loam

**Note:** Permeability of the Maysdorf soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more.

Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Decolney: 7 percent

Hiland: 5 percent

Forkwood: 4 percent

Moskee: 3 percent

Pugsley: 3 percent

Vonalee: 3 percent

#### **Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **179—Maysdorf-Pugsley sandy loams, 0 to 6 percent slopes**

#### **Setting**

**Elevation:** 4,200 to 5,100 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Maysdorf and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 5 inches; sandy loam  
 Bt—5 to 20 inches; sandy clay loam  
 Bk—20 to 60 inches; fine sandy loam

**Note:** Permeability of the Maysdorf soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

**Pugsley and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; sandy loam  
 Bt—4 to 15 inches; sandy clay loam  
 C—15 to 23 inches; fine sandy loam  
 Cr—23 to 60 inches; bedrock

**Note:** Permeability of the Pugsley soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bowbac: 4 percent  
 Cushman: 4 percent  
 Decolney: 4 percent  
 Forkwood: 4 percent  
 Hiland: 4 percent

**Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Pugsley soil and the high potential for seepage losses of all soils.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**180—Maysdorf-Pugsley sandy loams, 6 to 15 percent slopes****Setting**

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Maysdorf and similar soils**

Composition: 50 percent  
 Landform: Hill, Ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 5 inches; sandy loam

Bt—5 to 20 inches; sandy clay loam

Bk—20 to 60 inches; fine sandy loam

**Note:** Permeability of the Maysdorf soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

### Pugsley and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Eolian deposits over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; sandy loam

Bt—4 to 15 inches; sandy clay loam

C—15 to 23 inches; fine sandy loam

Cr—23 to 60 inches; bedrock

**Note:** Permeability of the Pugsley soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soils Series and Their Morphology.

### Additional Components

Bowbac: 5 percent

Decolney: 5 percent

Hiland: 5 percent

Vonalee: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Pugsley soil and the high potential for seepage losses on both soils.

This unit is moderately well suited for mechanical range renovation and range seeding. Mechanical

range renovation may not be economically feasible due to the coarse texture of the surface layer. The main limitation for range seeding is the hazard of water and wind erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 181—Moorhead clay loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Moorhead and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soils Series and Their Morphology.

### Additional Components

Deekay: 5 percent  
 Echeta: 5 percent  
 Felix, ponded: 5 percent  
 Jaywest: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat. Some areas are also used for homesite and urban development.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is the low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and the hazard of water and wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. This helps to reduce runoff and the hazard of water erosion. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

This unit is moderately suited for urban development. The main limitations are moderate shrink-swell potential and low strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of this soil to support a load.

For general and detailed information about managing this map unit, see the following sections

in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 182—Moorhead loam, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Moorhead and similar soils

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; loam  
 Bt—3 to 25 inches; clay loam  
 Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 5 percent  
 Felix, ponded: 5 percent  
 Jaywest: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat. A few areas are also used for homesite and urban development.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and the hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, increases the water intake rate, and helps reduce runoff and the hazard of water erosion. Wind erosion can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

This unit is moderately well suited for urban development. The main limitations are moderate shrink-swell potential and low strength. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of this soil to support a load.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **183—Moorhead-Leiter clay loams, 0 to 6 percent slopes**

#### **Setting**

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### **Major Component Description**

#### **Moorhead and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow.

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

#### **Leiter and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 3 inches; clay loam

Bt—3 to 22 inches; clay

Bk—22 to 33 inches; clay loam

Cr—33 to 60 inches; bedrock

**Note:** Permeability of the Leiter soil is slow.

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 4 percent  
 Deekay: 4 percent  
 Echeta: 4 percent  
 Jaywest: 4 percent  
 Spottedhorse: 4 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Moorhead soil is well suited for stockwater ponds. The Leiter soil is poorly suited. The main limitation is depth to bedrock.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 184—Moorhead-Leiter clay loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Moorhead and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Leiter and similar soils

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; clay loam

Bt—3 to 22 inches; clay

Bk—22 to 33 inches; clay loam

Cr—33 to 60 inches; bedrock

**Note:** Permeability of the Leiter soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 6 percent

Echeta: 7 percent

Jaywest: 7 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat. A few areas are also used for homesite and urban development.

The Moorhead soil is moderately well suited for stockwater ponds. The main limitation is slope. The Leiter soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited to homesite and urban development. The main limitations are the moderate shrink-swell potential, low strength of the soils, and slope. The depth to bedrock within the Leiter soil is also a limitation. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Buildings and roads should be designed to offset the limited ability of these soils to support a load. The deep cuts needed to provide essentially level building sites on the Leiter soil can create exposed areas of bedrock.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **185—Moskee fine sandy loam, 0 to 6 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Moskee and similar soils**

Composition: 85 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 9 inches; fine sandy loam

Bt—9 to 32 inches; sandy clay loam

Bk—32 to 60 inches; fine sandy loam

**Note:** Permeability of the Moskee soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Arwite: 3 percent

Deekay: 3 percent

Forkwood: 3 percent

Hiland: 3 percent

Recluse: 3 percent

#### **Use and Management**

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

This unit is moderately suited for nonirrigated cropland. The main limitations are low annual precipitation, droughtiness of the soil, and the hazard

of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips and at right angles to the prevailing wind.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **186—Moskee fine sandy loam, 6 to 10 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Moskee and similar soils**

Composition: 80 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### **Typical profile:**

A—0 to 4 inches; fine sandy loam

Bt—4 to 16 inches; sandy clay loam

Bk—16 to 60 inches; fine sandy loam

**Note:** Permeability of the Moskee soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

#### **Additional Components**

Arwite: 8 percent

Elwop: 8 percent

Areas with 10-15 percent slope: 4 percent

### **Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **187—Nuncho loam, 0 to 6 percent slopes**

#### **Setting**

**Elevation:** 4,300 to 5,200 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Nuncho and similar soils**

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### **Typical profile:**

A—0 to 12 inches; loam

Bt—12 to 30 inches; clay

Bk—30 to 60 inches; clay loam

**Note:** Permeability of the Nuncho soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Platmak: 4 percent  
 Recluse: 4 percent  
 Deekay: 3 percent  
 Forkwood: 3 percent  
 Moorhead: 3 percent  
 Ulm: 3 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This unit is moderately well suited to nonirrigated cropland. The main limitations are low annual precipitation and the hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Keeping the soil rough and cloddy when it is not protected by vegetation helps to control wind erosion. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 188—Orpha-Tullock loamy sands, 6 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Orpha and similar soils

Composition: 40 percent  
 Landform: Dune  
 Landform Element: Backslope, footslope  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Excessively drained  
 Parent Material: Eolian deposits derived from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 4 inches; loamy sand  
 C—4 to 60 inches; loamy sand  
**Note:** Permeability of the Orpha soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water and wind erosion is severe.

#### Tullock and similar soils

Composition: 40 percent  
 Landform: Dune  
 Landform Element: Shoulder, summit  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Excessively drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 8 inches; loamy sand  
 C—8 to 30 inches; loamy sand  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Tullock soil is rapid.

Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Embry: 5 percent  
Niobrara: 5 percent  
Terro: 5 percent  
Badland: 4 percent  
Blowouts: 1 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Tullock soil and the high potential of both soils for seepage losses.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitation is the hazard of erosion. Mechanical range renovation is not economically feasible due to the coarse texture of the surface layer. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 189—Oshoto-Moorhead loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 14 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Oshoto and similar soils

Composition: 50 percent  
Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 7 inches; silt loam

Bt—7 to 32 inches; silty clay loam

Bk—32 to 60 inches; silt loam

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

#### Moorhead and similar soils

Composition: 30 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; loam

Bt—5 to 35 inches; clay

Bk—35 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 5 percent  
Jaywest: 5 percent  
Nuncho: 5 percent  
Recluse: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Oshoto soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Moorhead soil is well suited for stockwater ponds.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 190—Parmleed-Renohill complex, 3 to 15 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Parmleed and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

##### Typical profile:

E—0 to 3 inches; loam

Bt—3 to 21 inches; clay

Bk—21 to 27 inches; clay loam

Cr—27 to 60 inches; bedrock

**Note:** Permeability of the Parmleed soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### Renohill and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
 weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Bidman: 4 percent

Savageton: 4 percent

Ulm: 4 percent

Worf: 4 percent

Worfka: 4 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is moderately well suited for mechanical range renovation and well suited for range seeding.

The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 191—Pits-Dumps complex

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Pits

Composition: 60 percent  
 Landform: None assigned  
 Landform Element: None assigned  
 Slope: None assigned  
 Depth to Restrictive Feature: None noted  
 Drainage Class: None assigned  
 Parent Material: None assigned  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: No seasonal ponding exists

**Note:** Open pits are vertical or very steep excavations into sedimentary rock consisting of rippable shale with interbedded sandstone and minor coal seams. The material is commonly medium textured, but some layers are coarse textured or fine textured.

#### Dumps

Composition: 40 percent  
 Landform: None assigned  
 Landform Element: None assigned  
 Slope: None assigned  
 Depth to Restrictive Feature: None noted  
 Drainage Class: None assigned  
 Parent Material: None assigned  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: No seasonal ponding exists

**Note:** Dump areas vary from relatively gently sloping overburden piles to very steep conical shaped piles which are characteristic of overburden placement with draglines. Included in dump areas are topsoil stockpiles which will be replaced on the recontoured surface during final reclamation.

### Additional Components

None

### Use and Management

This map unit consists of open pits and spoil material from small to large scale coal mining operations. Most areas are currently being mined and reclamation is not feasible at this time. This unit is about 60 percent pits and 40 percent dumps.

Onsite investigation of individual areas is necessary to determine reclamation potential. Backfilling excavations and reshaping cut slopes reduce the risk of erosion. Backfilling with suitable topsoil aids revegetation.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 192—Platmak loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Platmak and similar soils

Composition: 80 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

E—0 to 4 inches; loam

Bt—4 to 27 inches; clay

Bk—27 to 60 inches; clay loam

**Note:** Permeability of the Platmak soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Nuncho: 6 percent

Bidman: 4 percent

Jaywest: 4 percent

Deekay: 2 percent

Felix, ponded: 2 percent

Forkwood: 2 percent

**Use and Management**

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and moderate hazard of water and wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Wind erosion can be reduced by planting crops in alternate strips and at right angles to the prevailing wind. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control water and wind erosion. A tillage pan forms easily if this soil is tilled when wet. Chiseling or subsoiling can be used to break up the tillage pan.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**193—Pugsley-Decolney sandy loams, 0 to 6 percent slopes****Setting****Elevation:** 4,100 to 5,000 feet**Mean annual precipitation:** 10 to 14 inches**Frost-free period:** 105 to 130 days**Major Component Description****Pugsley and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Eolian deposits over residuum  
weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam

Bt—3 to 13 inches; sandy clay loam

C—13 to 25 inches; sandy loam

Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Pugsley soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

**Decolney and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium over eolian deposits  
derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam

Bt—3 to 22 inches; sandy clay loam

C1—22 to 43 inches; sandy loam

C2—43 to 60 inches; sandy loam

**Note:** Permeability of the Decolney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bowbac: 10 percent

Hiland: 10 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Pugsley soil and the high potential of both soils for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 194—Pugsley-Decolney sandy loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Pugsley and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam

Bt—3 to 13 inches; sandy clay loam

C—13 to 25 inches; sandy loam

Cr—25 to 60 inches; bedrock

**Note:** Permeability of the Pugsley soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water and wind erosion is severe.

### Decolney and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium over eolian deposits derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; sandy loam

Bt—3 to 22 inches; sandy clay loam

C1—22 to 43 inches; sandy loam

C2—43 to 60 inches; sandy loam

**Note:** Permeability of the Decolney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bowbac: 7 percent  
 Hiland: 7 percent  
 Worf: 6 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Pugsley soil and the high potential of both soils for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 195—Rauzi fine sandy loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 14 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Rauzi and similar soils

Composition: 85 percent  
 Landform: Fan remnants  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 30 inches; sandy clay loam  
 C—30 to 60 inches; sandy loam

**Note:** Permeability of the Rauzi soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arwite: 7 percent  
 Deekay: 2 percent  
 Elwop: 2 percent  
 Vonalf: 2 percent  
 Xema: 2 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat. A few areas are also used for homesite and urban development.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

This unit is well suited for homesite and urban development. The hazard of wind erosion increases if the soil is left exposed during site development. Revegetating disturbed areas around construction sites as soon as possible helps to control wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 196—Rauzi sandy clay loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Rauzi and similar soils

Composition: 75 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 6 inches; sandy clay loam  
 Bt—6 to 30 inches; sandy clay loam  
 C—30 to 60 inches; sandy loam  
**Note:** Permeability of the Rauzi soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arwite: 7 percent

Elwop: 6 percent

Moorhead: 6 percent

Moskee: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 197—Rauzi-Elwop fine sandy loams, 2 to 10 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Rauzi and similar soils

Composition: 60 percent  
 Landform: Hills  
 Landform Element: Backslope, footslope  
 Slope: 2 to 10 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; fine sandy loam  
 Bt—3 to 30 inches; sandy clay loam  
 C—30 to 60 inches; sandy loam  
**Note:** Permeability of the Rauzi soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

### Elwop and similar soils

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 2 to 10 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits  
 over residuum weathered from calcareous  
 sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bt—4 to 24 inches; sandy clay loam  
 Bk—24 to 35 inches; fine sandy loam  
 Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Elwop soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Arwrite: 5 percent  
 Julesburg: 5 percent  
 Vonalf: 4 percent  
 Xema: 4 percent  
 Areas with 0 to 2 percent slope: 2 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Elwop soil and the high potential of both soils for seepage losses.

This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of wind

erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 198—Recluse loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 14 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Recluse and similar soils

Composition: 80 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone  
 and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 5 inches; loam  
 Bt—5 to 23 inches; clay loam  
 Bk—23 to 60 inches; loam

**Note:** Permeability of the Recluse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 4 percent  
 Moskee: 4 percent

Nuncho: 4 percent  
 Oldwolf: 4 percent  
 Platmak: 4 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, nonirrigated cropland, and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This unit is moderately well suited for nonirrigated cropland. The main limitations are low annual precipitation and the hazard of wind erosion. Because of the low annual precipitation, a crop rotation that most effectively uses soil moisture should be used. Reducing or eliminating tillage operations increases the effective use of soil moisture. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control water and wind erosion. Wind erosion can be reduced by planting crops in alternate strips and at right angles to the prevailing wind.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 199—Renohill-Savageton clay loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Renohill and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, summit  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; clay loam  
 Bt—3 to 24 inches; clay  
 Bk—24 to 36 inches; clay loam  
 Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

### Savageton and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam  
 Bw—4 to 22 inches; clay  
 Bk—22 to 36 inches; clay loam  
 Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Savageton soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bidman: 4 percent  
Heldt: 4 percent  
Samday: 4 percent  
Ulm: 4 percent  
Worfka: 4 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 200—Renohill-Savageton clay loams, 6 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Renohill and similar soils

Composition: 50 percent  
Landform: Hill, ridge  
Landform Element: Backslope, summit  
Slope: 6 to 15 percent  
Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches  
Drainage Class: Well drained  
Parent Material: Alluvium over residuum  
weathered from calcareous shale  
Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; clay loam  
Bt—3 to 24 inches; clay  
Bk—24 to 36 inches; clay loam  
Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Savageton and similar soils

Composition: 30 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 6 to 15 percent  
Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches  
Drainage Class: Well drained  
Parent Material: Alluvium over residuum  
weathered from calcareous shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam  
Bw—4 to 22 inches; clay  
Bk—22 to 36 inches; clay loam  
Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Savageton soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Samday: 5 percent  
Ulm: 5 percent  
Shingle: 3 percent  
Theedle: 3 percent  
Silhouette: 2 percent  
Worfka: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 201—Renohill-Shingle-Worf complex, 3 to 15 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Renohill and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, summit  
 Slope: 3 to 10 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 4 inches; clay loam  
 Bt—4 to 20 inches; clay  
 Bk—20 to 30 inches; clay loam  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is very high. The hazard of water and wind erosion is moderate.

##### Shingle and similar soils

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from  
 sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 1 inches; loam  
 C—1 to 12 inches; loam  
 Cr—12 to 60 inches; bedrock  
**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### Worf and similar soils

Composition: 15 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from  
 sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 1 inches; loam  
 Bt—1 to 10 inches; clay loam  
 Bk—10 to 14 inches; clay loam  
 Cr—14 to 60 inches; bedrock  
**Note:** Permeability of the Worf soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cushman: 5 percent  
 Hilight: 5 percent  
 Ulm: 5 percent  
 Wags: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The Renohill soil is well suited and the Shingle and Worf soils are poorly suited for mechanical range renovation. Mechanical range renovation may not be economically feasible on the Shingle and Worf soils due to low potential to increase the amount of forage. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 202—Renohill-Worfka clay loams, 3 to 15 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Renohill and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, summit  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches

Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 4 inches; clay loam  
 Bt—4 to 20 inches; clay  
 Bk—20 to 30 inches; clay loam  
 Cr—30 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### Worfka and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 2 inches; clay loam  
 Bt—2 to 13 inches; clay  
 Bk—13 to 19 inches; clay loam  
 Cr—19 to 60 inches; bedrock

**Note:** Permeability of the Worfka soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Samday: 7 percent  
 Ulm: 7 percent  
 Shingle: 6 percent

## Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

The Renohill soil is well suited and the Worfka soil is poorly suited for mechanical range renovation. Mechanical range renovation may not be economically feasible on the Worfka soil due to low potential to increase the amount of forage. This unit is moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding. Renovation and tillage for seeding should be along the contour of the slope.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 203—Rockypoint-Iwait association, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Rockypoint and similar soils

Composition: 45 percent  
 Landform: Flood plain, stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 3 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: Occasional  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; loam  
 C—3 to 60 inches; stratified fine sandy loam to clay loam

**Note:** Permeability of the Rockypoint soil is moderate. Available water capacity is high. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Iwait and similar soils

Composition: 35 percent  
 Landform: Stream terrace  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 2 inches; loam  
 Bk—2 to 60 inches; clay loam  
**Note:** Permeability of the Iwait soil is moderate. Available water capacity is high. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Ashollow: 8 percent

Sodawells: 8 percent

Boruff: 2 percent

Poorly drained sandy soils: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range,

Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 204—Samday-Samday, cool-Shingle clay loams, 6 to 40 percent slopes

### Setting

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Samday and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; clay loam

C—2 to 16 inches; clay

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Samday soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Samday and similar soils

Composition: 25 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 1 inches; clay loam

C—1 to 10 inches; clay

Cr—10 to 60 inches; bedrock

**Note:** Permeability of the Samday, cool soil is slow. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is rapid. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Shingle and similar soils

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 3 inches; clay loam

C—3 to 16 inches; clay loam

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Badland: 5 percent

Cushman: 5 percent

Savageton: 5 percent

Theedle: 5 percent

Wibaux, thin solum: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding.

The main limitations are depth to bedrock, steepness of slope, and the hazard of water erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 205—Samday-Savageton clay loams, 3 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Samday and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; clay loam

C—2 to 16 inches; clay

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Samday soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Savageton and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; clay loam

Bw—5 to 15 inches; clay

Bk—15 to 28 inches; clay

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Savageton soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is moderate to severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Heldt: 5 percent

Hilight: 5 percent

Theedle: 5 percent

Worfka: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

The Samday soil is poorly suited for mechanical range renovation. Mechanical range renovation may not be economically feasible due to low potential to increase the amount of forage. The Savageton soil is well suited for mechanical range renovation. This unit is moderately well suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 206—Samday-Shingle-Badland complex, 10 to 45 percent slopes

### Setting

**Elevation:** 4,100 to 5,800 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Samday and similar soils

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 10 to 45 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; clay loam

C—2 to 16 inches; clay

Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Samday soil is slow.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Shingle and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 10 to 45 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

C—2 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Badland

Composition: 15 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: —

Depth to Restrictive Feature: Bedrock (paralithic):  
0 to 0 inches

Drainage Class: —

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Note:** Badland consists of exposures of shale  
and sandstone.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Areas with 45-60 percent slope: 4 percent

Hilight: 4 percent

Kishona: 4 percent

Theedle: 4 percent

Wags: 4 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas of the Rochelle Hills and on escarpments on the Pumpkin Buttes.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 207—Cromack-Fairburn-Ucross complex, 3 to 20 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Cromack and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 6 inches; clay loam  
 Bw—6 to 14 inches; clay  
 Bk—14 to 29 inches; clay  
 Cr—29 to 60 inches; bedrock

**Note:** Permeability of the Cromack soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Fairburn and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 20 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from  
 sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; loam

C—4 to 15 inches; loam

Cr—15 to 60 inches; bedrock

**Note:** Permeability of the Fairburn soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Ucross and similar soils

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 20 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 5 inches; loam  
 Bk—5 to 31 inches; clay loam  
 Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Ucross soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is moderate to severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Samsil: 5 percent  
 Badland: 4 percent  
 Iwait: 4 percent  
 Areas with 20-30 percent slope: 2 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat. Some areas are used for homesite and urban development.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock and steepness of slope.

The Cromack and Ucross soils are moderately well suited for mechanical range renovation. The main limitation is the hazard of water erosion. The Shingle soil is poorly suited for mechanical range renovation. Mechanical range renovation on the Shingle soil may not be economically feasible due to low potential to increase the amount of forage.

This unit is moderately suited for range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The use of tillage methods on areas with slopes greater than 15 percent is not recommended due to the hazard of water erosion. The low annual precipitation should be considered when planning a seeding.

This unit is poorly suited to homesite and urban development. The main limitations are depth to bedrock, shrink-swell potential, and low strength of the soils.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 208—Savageton-Silhouette clay loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Savageton and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam

Bw—4 to 12 inches; clay

Bk—12 to 38 inches; clay

Cr—38 to 60 inches; bedrock

**Note:** Permeability of the Savageton soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Silhouette and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from  
 calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; clay loam

Bw—2 to 28 inches; clay loam

Bk—28 to 60 inches; silty clay loam

**Note:** Permeability of the Silhouette soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Heldt: 5 percent

Renohill: 5 percent

Ulm: 5 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Savageton soil is poorly suited for stockwater ponds. The main limitation is the depth to bedrock. The Silhouette soil is well suited for stockwater ponds.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **209—Savageton-Silhouette clay loams, 6 to 15 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Savageton and similar soils**

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 3 inches; clay loam

Bw—3 to 19 inches; clay

Bk—19 to 36 inches; clay

Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Savageton soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### **Silhouette and similar soils**

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 3 inches; clay loam

Bw—3 to 15 inches; clay loam

Bk—15 to 60 inches; clay loam

**Note:** Permeability of the Silhouette soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid. The hazard of water erosion is moderate to severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Heldt: 5 percent

Reno Hill: 5 percent

Samday: 5 percent

Ulm: 5 percent

#### **Use and Management**

This unit is used as rangeland and wildlife habitat.

The Savageton soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Silhouette soil is moderately well suited for stockwater ponds. The main limitation is slope.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 210—Shingle-Taluze complex, 3 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Shingle and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

C—2 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Taluze and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; fine sandy loam

C—2 to 18 inches; fine sandy loam

Cr—18 to 60 inches; bedrock

**Note:** Permeability of the Taluze soil is rapid.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Theedle: 5 percent

Turnercrest: 5 percent

Vonalee: 4 percent

Worf: 4 percent

Badland: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas in the Rochelle Hills.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 211—Shingle-Worf loams, 3 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Shingle and similar soils

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 1 inches; loam

C—1 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Worf and similar soils**

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 1 inches; loam

Bt—1 to 10 inches; clay loam

Bk—10 to 14 inches; clay loam

Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Worf soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Cushman: 5 percent

Samday: 5 percent

Taluca: 5 percent

Theedle: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**212—Teckla very fine sandy loam, 0 to 10 percent slopes**

**Setting**

**Elevation:** 4,200 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Teckla and similar soils**

Composition: 80 percent

Landform: Terrace

Landform Element: None assigned

Slope: 0 to 10 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 10 inches; very fine sandy loam

Bt—10 to 23 inches; sandy clay loam

2Bt—23 to 31 inches; channery loam

2Bk—31 to 45 inches; very channery loam

3C—45 to 60 inches; extremely channery sandy loam

**Note:** Permeability of the Teckla soil is moderate in the upper part of the subsoil and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Forkwood: 7 percent  
Lawver: 7 percent  
Wibaux: 6 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 213—Terro-Taluce sandy loams, 6 to 30 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Terro and similar soils

Composition: 55 percent  
Landform: Hill, ridge  
Landform Element: Backslope, summit  
Slope: 6 to 30 percent  
Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches  
Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from calcareous sandstone  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

##### Typical profile:

A—0 to 3 inches; sandy loam  
Bt—3 to 19 inches; sandy loam  
Bk—19 to 38 inches; sandy loam  
Cr—38 to 60 inches; bedrock

**Note:** Permeability of the Terro soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water and wind erosion is severe.

##### Taluce and similar soils

Composition: 25 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 6 to 30 percent  
Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches  
Drainage Class: Well drained  
Parent Material: Residuum weathered from calcareous sandstone  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

##### Typical profile:

A—0 to 2 inches; sandy loam  
C—2 to 14 inches; sandy loam  
Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Taluce soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Keeline: 5 percent  
Orpha: 5 percent  
Turnercrest: 4 percent  
Vonalee: 4 percent  
Badland: 2 percent

## Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 214—Theedle-Kishona loams, 0 to 6 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Theedle and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

##### Typical profile:

A—0 to 4 inches; loam

Bk—4 to 36 inches; clay loam

Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

##### Kishona and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone  
 and shale

Flooding: None

Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; loam

Bk—4 to 60 inches; clay loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Cambria: 5 percent

Cushman: 5 percent

Forkwood: 5 percent

Turnercrest: 5 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Theedle soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Kishona soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 215—Theedle-Kishona loams, 6 to 20 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Theedle and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 20 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 4 inches; loam  
 Bk—4 to 36 inches; clay loam  
 Cr—36 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Kishona and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone  
 and shale

Flooding: None

Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; loam

Bk—4 to 60 inches; clay loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cushman: 5 percent

Savageton: 5 percent

Shingle: 5 percent

Silhouette: 5 percent

Zigweid: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

The Theedle soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Kishona soil is moderately well suited for stockwater ponds. The main limitations are the moderate potential for seepage losses and slope.

This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The use of tillage methods on areas with slopes greater than 15 percent is not recommended due to the hazard of water erosion. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 216—Theedle-Kishona-Shingle loams, 3 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Theedle and similar soils

Composition: 40 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bk—2 to 28 inches; clay loam

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is moderate to severe. The hazard of wind erosion is moderate.

#### Kishona and similar soils

Composition: 20 percent

Landform: Hill, ridge, fan remnant

Landform Element: Backslope, footslope

Slope: 3 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; loam

Bk—4 to 60 inches; clay loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Shingle and similar soils

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 5 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

C—2 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cambria: 5 percent

Hilight: 5 percent

Taluca: 5 percent

Turnercrest: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are depth to bedrock and steepness of slope.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitations

are slope and the hazard of water erosion. Tillage methods are not recommended.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 217—Theedle-Shingle loams, 3 to 30 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Theedle and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

Bk—2 to 28 inches; clay loam

Cr—28 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Shingle and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; loam

C—2 to 12 inches; loam

Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Keeline: 5 percent

Kishona: 5 percent

Samday: 5 percent

Taluca: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are depth to bedrock, steepness of slope, and the hazard of water erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 218—Theedle-Turnercrest-Kishona complex, 3 to 15 percent slopes

### Setting

**Elevation:** 4,100 to 5,100 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Theedle and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loam

Bk—3 to 35 inches; loam

Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Theedle soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Turnercrest and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
over residuum weathered from calcareous  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; fine sandy loam

C—2 to 34 inches; fine sandy loam

Cr—34 to 60 inches; bedrock

**Note:** Permeability of the Turnercrest soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

**Kishona and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 3 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone  
and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loam

Bk—4 to 60 inches; clay loam

**Note:** Permeability of the Kishona soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Areas with 15-20 percent slope: 4 percent

Jayem: 4 percent

Keeline: 4 percent

Taluca: 4 percent

Savageton: 2 percent

Shingle: 2 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

The Theedle and Turnercrest soils are poorly suited for stockwater ponds. The main limitation is the depth to bedrock. The Kishona soil is moderately well suited for stockwater ponds. The main limitations are the moderate potential for seepage losses and slope.

The Theedle and Kishona soils are well suited and the Turnercrest soil is moderately well suited for mechanical range renovation. Mechanical range renovation may not be economically feasible on the Turnercrest soil due to the coarse texture of the surface layer.

This unit is moderately well suited for range seeding. The main limitation is the hazard of water and wind erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 219—Torriarents-Torriorthents complex, reclaimed

### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 16 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Torriarents and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 2 to 20 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Mine spoil or earthy fill derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; variable  
 C—4 to 60 inches; variable

**Notes:** Permeability of the Torriarents is moderately slow. Available water capacity is high. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Torriorthents and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 2 to 20 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Mine spoil or earthy fill derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 5 inches; variable  
 C—5 to 60 inches; variable

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Use and Management

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

This unit responds well to fertilizer, range seeding, and proper grazing use. The main limitation for seeding is the hazard of water erosion. Adequate residue must be maintained on the surface at all times until the seeding is established. Management practices suitable for use on this unit include proper range use, deferred grazing, mowing, and rotation grazing. Livestock grazing should be managed to protect the soil from erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 220—Pitchdraw-Ashollow-Niobrara complex, 3 to 30 percent slopes

### Setting

**Elevation:** 4,300 to 5,200 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Pitchdraw and similar soils

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; fine sandy loam  
 Bk—4 to 31 inches; fine sandy loam  
 Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Pitchdraw soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water and wind erosion is severe.

#### Ashollow and similar soils

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous sandstone and/or eolian deposits  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 5 inches; fine sandy loam  
 C—5 to 60 inches; fine sandy loam

**Note:** Permeability of the Ashollow soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

#### Niobrara and similar soils

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Excessively drained  
 Parent Material: Residuum weathered from sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 3 inches; loamy sand  
 C—3 to 12 inches; sand  
 Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Niobrara soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Elwop: 4 percent  
 Jayem: 4 percent  
 Vonalf: 4 percent  
 Xema: 4 percent  
 Badland: 2 percent  
 Blowouts: 2 percent

#### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations for stockwater ponds are the high potential for seepage losses and steepness of slope. The depth to bedrock within the Turnercrest and Niobrara soils is a limitation for stockwater ponds. The main limitations for range seeding and range renovation are slope and the hazard of water and wind erosion.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

#### 221—Turnercrest-Keeline-Taluca fine sandy loams, 6 to 30 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

#### Major Component Description

#### Turnercrest and similar soils

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone

Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; fine sandy loam  
 C—2 to 32 inches; fine sandy loam  
 Cr—32 to 60 inches; bedrock

**Note:** Permeability of the Turnercrest soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water and wind erosion is severe.

**Keeline and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 6 to 20 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; fine sandy loam  
 C—4 to 60 inches; fine sandy loam

**Note:** Permeability of the Keeline soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is severe.

**Taluce and similar soils**

Composition: 15 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches

Drainage Class: Well drained  
 Parent Material: Residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; fine sandy loam  
 C—2 to 14 inches; fine sandy loam  
 Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Taluce soil is rapid.

Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Orpha: 5 percent

Terro: 5 percent

Tulloch: 5 percent

Vonalee: 5 percent

**Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations for stockwater ponds are the high potential for seepage losses and steepness of slope. The depth to bedrock within the Turnercrest and Taluce soils is also a limitation. The main limitations for range seeding and mechanical range renovation are the hazard of erosion and steepness of slope. Mechanical range renovation may not be economically feasible due to the low potential to increase the amount of forage on the Taluce soil and the coarse texture of the surface layer of all of the soils.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**222—Turnercrest-Wibaux, thin solum-Taluce complex, 6 to 40 percent slopes**

**Setting**

**Elevation:** 4,200 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Turnercrest and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, summit

Slope: 6 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits  
over residuum weathered from calcareous  
sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; loamy sand

C—3 to 22 inches; sandy loam

Cr—22 to 60 inches; bedrock

**Note:** Permeability of the Turnercrest soil is  
moderately rapid. Available water capacity is  
very low. Effective rooting depth is 20 to 40  
inches. Runoff is low. The hazard of water and  
wind erosion is severe.

**Wibaux, thin solum and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Strongly contrasting  
textural stratification: 6 to 10 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or colluvium over  
residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 3 inches; very channery loam

C—3 to 9 inches; extremely channery loam

2C—9 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux, thin solum soil  
is moderately rapid in the surface layer and  
very rapid in the underlying material. Available  
water capacity is very low. Effective rooting  
depth is variable due to the fractured nature of  
the porcelanite. Runoff is medium. The hazard  
of water erosion is moderate. The hazard of  
wind erosion is slight.

**Taluce and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
10 to 20 inches

Drainage Class: Well drained

Parent Material: Residuum weathered from  
calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; sandy loam

C—2 to 14 inches; sandy loam

Cr—14 to 60 inches; bedrock

**Note:** Permeability of the Taluce soil is rapid.

Available water capacity is very low. Effective  
rooting depth is 10 to 20 inches. Runoff is very  
high. The hazard of water and wind erosion is  
severe.

Typical soil descriptions with range in characteristics  
are included, in alphabetical order, in the section Soil  
Series and Their Morphology.

**Additional Components**

Keeline: 7 percent

Tulloch: 7 percent

Badland: 4 percent

Areas with 40-60 percent slope: 2 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds,  
mechanical range renovation, and range seeding.  
The main limitations for stockwater ponds are slope  
and the depth to bedrock. The main limitations for  
range seeding and mechanical range renovation are  
slope and the hazard of erosion. Tillage methods are  
not recommended.

For general and detailed information about managing  
this map unit, see the following sections in Part II of  
this publication: Agronomy, Range, Recreation,  
Wildlife Habitat, Engineering, and Soil Properties.

**223—Ucross loam, 1 to 9 percent slopes**

**Setting**

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Ucross and similar soils**

Composition: 80 percent

Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 1 to 9 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 5 inches; loam  
 Bk—5 to 31 inches; clay loam  
 Cr—31 to 60 inches; bedrock

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 7 percent  
 Fairburn: 7 percent  
 Iwait: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 224—Ucross-Iwait loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ucross and similar soils

Composition: 50 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 5 inches; loam  
 Bk—5 to 31 inches; clay loam  
 Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Ucross soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Iwait and similar soils

Composition: 30 percent  
 Landform: Fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone  
 and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

**Typical profile:**

A—0 to 6 inches; loam

Bk—6 to 60 inches; clay loam

**Note:** Permeability of the Iwait soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 7 percent

Ziggy: 7 percent

Oldwolf: 6 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

The Ucross soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock. The Iwait soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 225—Ucross-Iwait-Fairburn loams, 3 to 30 percent slopes

### Setting

**Elevation:** 4,300 to 5,000 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ucross and similar soils

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 30 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; loam

Bk—5 to 31 inches; clay loam

Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Ucross soil is moderate.

Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high.

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

#### Iwait and similar soils

Composition: 25 percent

Landform: Hill, ridge, fan remnant

Landform Element: Backslope, footslope

Slope: 3 to 20 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone  
and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 6 inches; loam

Bk—6 to 60 inches; clay loam

**Note:** Permeability of the Iwait soil is moderate.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium.

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

**Fairburn and similar soils**

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 5 to 30 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from  
 sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; loam  
 C—4 to 15 inches; loam  
 Cr—15 to 60 inches; bedrock

**Note:** Permeability of the Fairburn soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Cromack: 4 percent  
 Deekay: 4 percent  
 Mittenbutte: 4 percent  
 Pitchdraw: 4 percent  
 Ziggy: 4 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is depth to bedrock and steepness of slope.

This unit is poorly suited for mechanical range renovation and range seeding. The main limitations are slope and the hazard of water erosion. The use of tillage methods is not recommended due to the hazard of water erosion and steepness of slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**226—Ulm loam, 0 to 6 percent slopes****Setting**

**Elevation:** 4,100 to 5,000 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Ulm and similar soils**

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from  
 calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet

Ponding: None

**Typical profile:**

A—0 to 2 inches; loam  
 Bt—2 to 25 inches; clay loam  
 Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bidman: 8 percent  
 Forkwood: 7 percent

**Use and Management**

This unit is used primarily as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This soil is well suited for stockwater ponds, mechanical range renovation, and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low

annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 227—Ulm clay loam, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ulm and similar soils

Composition: 85 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam

Bt—4 to 25 inches; clay

Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is to medium. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Bidman: 5 percent

Heldt: 5 percent

Wyarno: 5 percent

### Use and Management

This unit is used primarily as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 228—Ulm-Renohill clay loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ulm and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 0 to 6 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; clay loam

Bt—4 to 25 inches; clay

Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

**Renohill and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 0 to 6 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium over residuum  
weathered from calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow.

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bidman: 4 percent

Parmleed: 4 percent

Savageton: 3 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

The Ulm soil is well suited and the Renohill soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and range seeding. To reduce the

hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**229—Ulm-Renohill clay loams, 6 to 15 percent slopes****Setting****Elevation:** 4,100 to 5,200 feet**Mean annual precipitation:** 10 to 14 inches**Frost-free period:** 105 to 130 days**Major Component Description****Ulm and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from  
calcareous shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; clay loam

Bt—4 to 25 inches; clay

Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Renohill and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 40 inches

Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; clay loam  
 Bt—4 to 24 inches; clay  
 Bk—24 to 35 inches; clay loam  
 Cr—35 to 60 inches; bedrock

**Note:** Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Bidman: 5 percent  
 Parmleed: 5 percent  
 Savageton: 5 percent  
 Workka: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

The Ulm soil is moderately well suited for stockwater ponds. The main limitation is slope. The Renohill soil is poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**230—Urban land-Deekay-Moorhead complex, 0 to 6 percent slopes****Setting**

**Elevation:** 4,300 to 4,600 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Urban land**

Composition: 40 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: —  
 Depth to Restrictive Feature: None noted  
 Drainage Class: —  
 Parent Material: Mine spoil or earthy fill derived from sandstone and shale  
 Flooding: —  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: No seasonal ponding exists  
**Note:** Urban land is land where most of the surface is covered by streets, parking lots, buildings, and other structures of urban areas. In areas where the surface is not covered, the original soil has commonly been altered by excavation or built-up with fill from various sources.

**Deekay and similar soils**

Composition: 25 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 4 inches; loam  
 Bt—4 to 23 inches; clay loam  
 Bk—23 to 60 inches; loam  
**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high.

Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

### Moorhead and similar soils

Composition: 25 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 6 inches; clay loam  
 Bt—6 to 24 inches; clay  
 Bk—24 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water erosion is slight to moderate. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Echeta: 3 percent  
 Jaywest: 3 percent  
 Felix, ponded: 2 percent  
 Ucross: 2 percent

### Use and Management

This unit is used mainly for housing, urban development, and recreation.

This unit is moderately well suited for urban development. The main limitations of the Deekay and Moorhead soils are low strength and moderate shrink-swell potential. Buildings and roads should be designed to offset the limited ability of these soils to support a load. The effects of shrinking and swelling on these soils can be minimized by using proper engineering designs and backfilling with material that has low shrink-swell potential.

For general and detailed information about managing this map unit, see the following sections in Part II of

this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 231—Urban land-Leiter-Moorhead complex, 3 to 10 percent slopes

### Setting

**Elevation:** 4,300 to 4,600 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Urban land

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: —  
 Depth to Restrictive Feature: None noted  
 Drainage Class: —  
 Parent Material: Mine spoil or earthy fill derived from sandstone and shale  
 Flooding: —  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: No seasonal ponding exists  
**Note:** Urban land is land where most of the surface is covered by streets, parking lots, buildings, and other structures of urban areas. In areas where the surface is not covered, the original soil has commonly been altered by excavation or built-up with fill from various sources.

#### Leiter and similar soils

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 10 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; clay loam  
 Bt—3 to 22 inches; clay  
 Bk—22 to 33 inches; clay loam

Cr—33 to 60 inches; bedrock

**Note:** Permeability of the Leiter soil is slow.

Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high.

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

### Moorhead and similar soils

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 3 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from calcareous shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam

Bt—4 to 24 inches; clay

Bk—24 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow.

Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe.

The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 5 percent

Deekay: 5 percent

### Use and Management

This unit is used mainly for housing, urban development, and recreation.

This unit is moderately well suited for urban development. The main limitations of the Leiter and Moorhead soils are low strength, moderate shrink-swell potential, and slope. The Leiter soil is also limited by depth to bedrock. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. The possibility of settlement can be minimized by compacting the building site before construction begins. The effects of shrinking and swelling on these soils can be minimized by using proper engineering designs and

by backfilling with material that has low shrink-swell potential. Diverting runoff away from buildings helps prevent structural damage caused by shrinking and swelling. The deep cuts needed to provide essentially level building sites on the Leiter soil can expose bedrock.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 232—Urban land-Pitchdraw-Ashollow complex, 6 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,600 feet

**Mean annual precipitation:** 14 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Urban land

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: —

Depth to Restrictive Feature: None noted

Drainage Class: —

Parent Material: Mine spoil or earthy fill derived from sandstone and shale

Flooding: —

Water Table: No water table exists above a depth of 6 feet

Ponding: No seasonal ponding exists

**Note:** Urban land is land where most of the surface is covered by streets, parking lots, buildings, and other structures of urban areas. In areas where the surface is not covered, the original soil has commonly been altered by excavation or built-up with fill from various sources.

#### Pitchdraw and similar soils

Composition: 25 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 15 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits

over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; fine sandy loam

Bk—4 to 31 inches; fine sandy loam

Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Pitchdraw soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water and wind erosion is severe.

**Ashollow and similar soils**

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Eolian deposits over alluvium derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 5 inches; fine sandy loam

C—5 to 60 inches; fine sandy loam

**Note:** Permeability of the Ashollow soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Arwite: 2 percent

Valent: 2 percent

Elwop: 2 percent

Mittenbutte: 2 percent

Areas with 15-20 percent slope: 1 percent

Areas with 3-6 percent slope: 1 percent

**Use and Management**

This unit is used mainly for housing, urban development, and recreation.

The Turnercrest soil is moderately suited for urban development. The main limitation is the depth to bedrock. The Keeline soil is moderately well suited to urban development. The main limitation is slope. Excavation for houses and access roads exposes material that is highly susceptible to wind erosion. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. The deep cuts needed to provide essentially level sites on the Turnercrest soil can create exposed areas of bedrock.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**233—Ustic Torriorthents, gullied**

**Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

**Major Component Description**

**Ustic Torriorthents and similar soils**

Composition: 80 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 10 to 80 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 60 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

**Typical profile:**

A—0 to 4 inches; loam

Bk—4 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** These soils are highly variable within a delineation and from one delineation to another. Textures of the surface and underlying material are variable and range from loamy fine sand to clay.

Permeability of the Ustic Torriorthents, gullied soil ranges from moderately slow to moderately rapid. Available water capacity is

high. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Haverdad: 5 percent

Kishona: 5 percent

Shingle: 5 percent

Theedle: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 234—Ustic Torriorthents-Badland complex, 10 to 100 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ustic Torriorthents and similar soils

Composition: 65 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 10 to 80 percent

Depth to Restrictive Feature: Bedrock (paralithic):  
20 to 60 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or residuum  
weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

### Typical profile:

A—0 to 4 inches; loam

Bk—4 to 35 inches; clay loam

Cr—35 to 60 inches; bedrock

**Note:** These soils are highly variable within a delineation and from one delineation to another. Textures of the surface and underlying material are variable and range from loamy fine sand to clay.

Permeability of the Ustic Torriorthents, gullied soil ranges from moderately slow to moderately rapid. Available water capacity is high. Runoff is very high. The hazard of water and wind erosion is severe.

### Badland

Composition: 20 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: —

Depth to Restrictive Feature: Bedrock (paralithic):  
0 to 0 inches

Drainage Class: —

Parent Material: Residuum weathered from  
sandstone and shale

Flooding: None

Water Table: No water table exists above a depth  
of 6 feet

Ponding: None

**Note:** Badland consists of exposures of  
sandstone, shale, or consolidated porcelanite.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Samday: 5 percent

Shingle: 5 percent

Taluce: 5 percent

Theedle: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range,

Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 235—Vonalee fine sandy loam, 0 to 10 percent slopes

#### Setting

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Vonalee and similar soils

Composition: 80 percent

Landform: Alluvial fan, fan remnant

Landform Element: None assigned

Slope: 0 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; fine sandy loam

Bt—3 to 24 inches; fine sandy loam

Bk—24 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalee soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

#### Additional Components

Hiland: 6 percent

Keeline: 6 percent

Terro: 6 percent

Areas with 10-15 percent slope: 2 percent

#### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

This unit is moderately well suited for mechanical range renovation and range seeding. The main

limitation for range seeding is the hazard of wind erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. To reduce the hazard of wind erosion, adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation and the droughtiness of the soils. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 236—Vonalee-Terro fine sandy loams, 2 to 10 percent slopes

#### Setting

**Elevation:** 4,100 to 5,000 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Vonalee and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 2 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 3 inches; fine sandy loam

Bt—3 to 24 inches; fine sandy loam

Bk—24 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalee soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water

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

### **Terro and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 2 to 10 percent  
 Depth to Restrictive Feature: Bedrock (paralithic):  
 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum  
 weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### **Typical profile:**

A—0 to 3 inches; fine sandy loam  
 Bt—3 to 16 inches; fine sandy loam  
 Bk—16 to 30 inches; fine sandy loam  
 Cr—30 to 60 inches; bedrock

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

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### **Additional Components**

Bowbac: 5 percent  
 Orpha: 5 percent  
 Taluce: 5 percent  
 Tullock: 4 percent  
 Areas with 10-15 percent slope: 1 percent

### **Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the Terro soil and the high potential of both soils for seepage losses.

This unit is moderately well suited for mechanical range renovation and range seeding. The main limitation for range seeding is the hazard of wind erosion. Mechanical range renovation may not be economically feasible due to the coarse texture of the surface layer. To reduce the hazard of wind erosion,

adequate residue must be maintained on the surface at all times until the seeding is established. Tilled areas must remain narrow and at right angles to the wind. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## **237—Vonalf fine sandy loam, 0 to 6 percent slopes**

### **Setting**

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### **Major Component Description**

#### **Vonalf and similar soils**

Composition: 85 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits  
 derived from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth  
 of 6 feet  
 Ponding: None

#### **Typical profile:**

A—0 to 6 inches; fine sandy loam  
 Bt—6 to 34 inches; fine sandy loam  
 Bk—34 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalf soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is slight. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### **Additional Components**

Arwite: 5 percent  
 Jayem: 5 percent  
 Xema: 5 percent

### Use and Management

This unit is used primarily as rangeland, nonirrigated hayland and pasture, and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitation is the high potential for seepage losses.

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

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation and the droughtiness of the soil. Rotation grazing maintains optimum vigor and quality of forage.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### 238—Vonalf-Xema fine sandy loams, 3 to 10 percent slopes

#### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### Major Component Description

##### Vonalf and similar soils

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 3 to 10 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits derived from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 6 inches; fine sandy loam

Bt—6 to 34 inches; fine sandy loam

Bk—34 to 60 inches; fine sandy loam

**Note:** Permeability of the Vonalf soil is moderately rapid. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

##### Xema and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 10 percent

Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or eolian deposits over residuum weathered from calcareous sandstone

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

##### Typical profile:

A—0 to 4 inches; fine sandy loam

Bt—4 to 22 inches; fine sandy loam

Bk—22 to 31 inches; fine sandy loam

Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Xema soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is low. The hazard of water erosion is moderate. The hazard of wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### Additional Components

Arwite: 6 percent

Ashollow: 6 percent

Mittenbutte: 6 percent

Areas with 10-15 percent slope: 2 percent

#### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds. The main limitations are the depth to bedrock within the

Xema soil and the high potential of both soils for seepage losses.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **239—Ironbutte-Fairburn-Mittenbutte complex, 6 to 40 percent slopes**

#### **Setting**

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Ironbutte and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium derived from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### **Typical profile:**

A—0 to 4 inches; channery loam  
 C—4 to 12 inches; very channery loam  
 2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of

porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is slight.

##### **Fairburn and similar soils**

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### **Typical profile:**

A—0 to 4 inches; loam  
 C—4 to 15 inches; loam  
 Cr—15 to 60 inches; bedrock

**Note:** Permeability of the Fairburn soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### **Mittenbutte and similar soils**

Composition: 25 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from calcareous sandstone  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

##### **Typical profile:**

A—0 to 3 inches; fine sandy loam  
 C—3 to 16 inches; fine sandy loam  
 Cr—16 to 60 inches; bedrock

**Note:** Permeability of the Mittenbutte soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water and wind erosion is severe.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Badland: 5 percent  
Pitchdraw: 5 percent  
Samsil: 5 percent  
Ucross: 5 percent

### Use and Management

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitations are slope and the depth to bedrock.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 240—Wibaux-Wibaux, thin solum complex, 6 to 40 percent slopes

### Setting

**Elevation:** 4,200 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Wibaux and similar soils

Composition: 60 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 6 to 40 percent  
Depth to Restrictive Feature: Strongly contrasting textural stratification: 6 to 10 inches  
Drainage Class: Well drained  
Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

#### Typical profile:

A—0 to 3 inches; channery fine sandy loam  
C—3 to 16 inches; very channery loam  
2C—16 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux soil is moderately rapid in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Wibaux and similar soils

Composition: 20 percent  
Landform: Hill, ridge  
Landform Element: Summit, shoulder  
Slope: 6 to 40 percent  
Depth to Restrictive Feature: Strongly contrasting textural stratification: 6 to 10 inches  
Drainage Class: Well drained  
Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet  
Ponding: None

#### Typical profile:

A—0 to 3 inches; very channery loam  
C—3 to 9 inches; extremely channery loam  
2C—9 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux, thin solum soil is moderately rapid in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is moderate. The hazard of wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Badland: 4 percent  
Teckla: 4 percent  
Wibaux very channery loam: 4 percent  
Wibaux, thin solum very channery fine sandy loam: 4 percent  
Areas with 3-6 percent slope: 2 percent  
Areas with 40-60 percent slope: 2 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas of the Rochelle Hills.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 241—Ironbutte-Ironbutte, thin solum channery loams, 6 to 40 percent slopes

### Setting

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ironbutte and similar soils

Composition: 55 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or colluvium derived from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; channery loam

C—4 to 12 inches; very channery loam

2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is slight.

#### Ironbutte and similar soils

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 6 to 40 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 6 to 10 inches

Drainage Class: Well drained

Parent Material: Eolian deposits over residuum weathered from scoria

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; channery loam

C—2 to 10 inches; very channery loam

2C—10 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte, thin solum soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Areas with 3-6 percent slope: 4 percent

Muleherder: 4 percent

Rockybutte: 4 percent

Badland: 3 percent

### Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas of the Rochelle Hills.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 242—Ironbutte-Deekay-Moorhead association, 3 to 30 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Ironbutte and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 30 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium derived from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; channery loam  
 C—4 to 12 inches; very channery loam  
 2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is slight.

### Deekay and similar soils

Composition: 20 percent  
 Landform: Fan remnant, hill  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; loam  
 Bt—4 to 23 inches; clay loam  
 Bk—23 to 60 inches; loam

**Note:** Permeability of the Deekay soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

### Moorhead and similar soils

Composition: 15 percent  
 Landform: Fan remnant, hill  
 Landform Element: Backslope, footslope  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; loam  
 Bt—4 to 26 inches; clay  
 Bk—26 to 60 inches; clay loam

**Note:** Permeability of the Moorhead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

## Additional Components

Iwait: 4 percent  
 Jaywest: 4 percent  
 Rockybutte: 4 percent  
 Fairburn: 3 percent  
 Ucross: 3 percent  
 Areas with 30-60 percent slope: 2 percent

## Use and Management

This unit is used as rangeland and wildlife habitat.

The Wibaux soil is poorly suited for stockwater ponds, mechanical range renovation, and range seeding. The main limitation is steepness of slope. The Deekay and Moorhead soils are moderately well suited for stockwater ponds. The main limitations are the moderate potential for seepage losses and slope.

The Wibaux soil is poorly suited for mechanical range renovation and range seeding. The main limitations are the amount of rock fragments in the surface layer and the steepness of slope. The Deekay and Moorhead soils are moderately well suited for mechanical range renovation and range seeding. The main limitation is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the

seeding is established. Renovation and tillage for seeding should be along the contour of the slope. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **243—Wibaux, thick solum-Wibaux channery fine sandy loams, 3 to 40 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 5,200 feet

**Mean annual precipitation:** 10 to 14 inches

**Frost-free period:** 105 to 130 days

#### **Major Component Description**

##### **Wibaux and similar soils**

Composition: 45 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 3 to 30 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches

Drainage Class: Somewhat excessively drained

Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 5 inches; channery fine sandy loam

Bk—5 to 23 inches; very channery fine sandy loam

2C—23 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux, thick solum soil is moderately rapid in the upper part of the subsoil and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

##### **Wibaux and similar soils**

Composition: 35 percent

Landform: Hill, ridge

Landform Element: Summit, shoulder

Slope: 3 to 40 percent

Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches

Drainage Class: Well drained

Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 3 inches; channery fine sandy loam

C—3 to 16 inches; extremely channery sandy clay loam

2C—16 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux soil is moderately rapid in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

#### **Additional Components**

Badland: 5 percent

Lawver: 5 percent

Teckla: 5 percent

Wibaux, thin solum: 5 percent

#### **Use and Management**

This unit is used as rangeland and wildlife habitat.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

### **244—Muleherder-Ironbutte channery loams, 3 to 40 percent slopes**

#### **Setting**

**Elevation:** 4,100 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

## Major Component Description

### Muleherder and similar soils

Composition: 45 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, footslope  
 Slope: 3 to 30 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium derived from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 2 inches; channery loam  
 Bw—2 to 16 inches; channery loam  
 Bc—16 to 33 inches; extremely channery fine sandy loam  
 2C—33 to 60 inches; fragmental material

**Note:** Permeability of the Muleherder soil is moderate in the upper part of the subsoil and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is slight.

### Ironbutte and similar soils

Composition: 40 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 40 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium derived from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 4 inches; channery loam  
 C—4 to 12 inches; very channery loam  
 2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Ironbutte soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is

variable due to the fractured nature of porcelanite. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is slight.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

## Additional Components

Brislawn: 4 percent  
 Ironbutte, thin solum: 4 percent  
 Rockybutte: 4 percent  
 Badland: 3 percent

## Use and Management

This unit is used as rangeland and wildlife habitat. Occasional coniferous trees occur in some areas of the Rochelle Hills.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 245—Wibaux-Shingle-Badland complex, 6 to 60 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

## Major Component Description

### Wibaux and similar soils

Composition: 35 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 60 percent  
 Depth to Restrictive Feature: Strongly contrasting textural stratification: 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or colluvium over residuum weathered from porcelanite  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 4 inches; channery loam  
 C—4 to 12 inches; very channery loam  
 2C—12 to 60 inches; fragmental material

**Note:** Permeability of the Wibaux soil is moderate in the upper part and very rapid in the underlying material. Available water capacity is very low. Effective rooting depth is variable due to the fractured nature of porcelanite. Runoff is low. The hazard of water erosion is severe. The hazard of wind erosion is slight.

**Shingle and similar soils**

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 6 to 60 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 10 to 20 inches  
 Drainage Class: Well drained  
 Parent Material: Residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

**Typical profile:**

A—0 to 1 inches; loam  
 C—1 to 12 inches; loam  
 Cr—12 to 60 inches; bedrock

**Note:** Permeability of the Shingle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

**Badland**

Composition: 15 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: —  
 Depth to Restrictive Feature: Bedrock (paralithic): 0 to 0 inches  
 Drainage Class: —  
 Parent Material: Residuum weathered from sandstone and shale  
 Flooding: —  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: No seasonal ponding exists  
**Note:** Badland consists of exposures of shale, sandstone, and porcelanite.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

**Additional Components**

Renohill: 5 percent  
 Samday: 5 percent  
 Taluce: 5 percent  
 Theedle: 5 percent

**Use and Management**

This unit is used as rangeland and wildlife habitat.

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

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

**246—Wyarno-Ulm clay loams, 0 to 6 percent slopes****Setting**

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

**Major Component Description****Wyarno and similar soils**

Composition: 50 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; clay loam  
 Bt—3 to 12 inches; clay  
 Bk—12 to 60 inches; clay loam  
**Note:** Permeability of the Wyarno soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is

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

### Ulm and similar soils

Composition: 30 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 4 inches; clay loam  
 Bt—4 to 25 inches; clay  
 Bk—25 to 60 inches; clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Renhill: 8 percent  
 Forkwood: 7 percent  
 Heldt: 5 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

This unit is well suited for stockwater ponds, mechanical range renovation, and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 247—Wytote-Ulm loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,100 to 5,200 feet  
**Mean annual precipitation:** 10 to 14 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Wytote and similar soils

Composition: 50 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium and/or eolian deposits derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 2 inches; loam  
 Bt—2 to 38 inches; silty clay loam  
 Bk—38 to 60 inches; silt loam

**Note:** Permeability of the Wytote soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very low. The hazard of water and wind erosion is moderate.

#### Ulm and similar soils

Composition: 30 percent  
 Landform: Alluvial fan, fan remnant  
 Landform Element: None assigned  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from calcareous shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None

#### Typical profile:

A—0 to 6 inches; loam  
 Bt—6 to 23 inches; silty clay  
 Bk—23 to 60 inches; silty clay loam

**Note:** Permeability of the Ulm soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium. The hazard of water and wind erosion is moderate.

### Additional Components

Cambria: 7 percent  
Forkwood: 7 percent  
Recluse: 6 percent

### Use and Management

This unit is used primarily as rangeland and wildlife habitat.

The Wyotite soil is moderately well suited for stockwater ponds. The main limitation is the moderate potential for seepage losses. The Ulm soil is well suited for stockwater ponds.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be considered when planning a seeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 248—Ziggy-Iwait loams, 0 to 6 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet  
**Mean annual precipitation:** 15 to 17 inches  
**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ziggy and similar soils

Composition: 50 percent  
Landform: Alluvial fan, fan remnant  
Landform Element: None assigned  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: None noted  
Drainage Class: Well drained  
Parent Material: Alluvium derived from sandstone and shale

Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; loam  
Bw—5 to 14 inches; loam  
Bk—14 to 60 inches; clay loam

**Note:** Permeability of the Ziggy soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

#### Iwait and similar soils

Composition: 30 percent  
Landform: Alluvial fan, fan remnant  
Landform Element: None assigned  
Slope: 0 to 6 percent  
Depth to Restrictive Feature: None noted  
Drainage Class: Well drained  
Parent Material: Alluvium derived from sandstone and shale  
Flooding: None  
Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 6 inches; loam  
Bk—6 to 60 inches; clay loam

**Note:** Permeability of the Iwait soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water erosion is slight. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Deekay: 5 percent  
Moorhead: 5 percent  
Oldwolf: 5 percent  
Recluse: 5 percent

### Use and Management

This unit is used as rangeland, nonirrigated hayland and pasture, and wildlife habitat. A few areas are also used for homesite and urban development.

This unit is moderately well suited for stockwater ponds. The main limitation is the moderate seepage potential.

This unit is well suited for mechanical range renovation and range seeding. Adequate residue must be maintained on the surface at all times until the seeding is established. The low annual precipitation should be of concern when reseeding.

This unit is moderately well suited for nonirrigated hayland and pasture. The main limitation is low annual precipitation. Rotation grazing maintains optimum vigor and quality of forage.

This unit is well suited to homesite and urban development. It has few limitations.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## **249—Ziggy-Iwait loams, 6 to 15 percent slopes**

### **Setting**

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### **Major Component Description**

#### **Ziggy and similar soils**

Composition: 50 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 5 inches; loam

Bw—5 to 14 inches; loam

Bk—14 to 60 inches; clay loam

**Note:** Permeability of the Ziggy soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is moderate.

#### **Iwait and similar soils**

Composition: 30 percent

Landform: Hill, ridge

Landform Element: Backslope, footslope

Slope: 6 to 15 percent

Depth to Restrictive Feature: None noted

Drainage Class: Well drained

Parent Material: Alluvium derived from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### **Typical profile:**

A—0 to 6 inches; loam

Bk—6 to 60 inches; clay loam

**Note:** Permeability of the Iwait soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### **Additional Components**

Deekay: 5 percent

Oldwolf: 5 percent

Pitchdraw: 5 percent

Ucross: 5 percent

### **Use and Management**

This unit is used as rangeland and wildlife habitat.

This unit is moderately well suited for stockwater ponds. The main limitations are the moderate seepage potential and slope.

This unit is well suited for mechanical range renovation and moderately well suited for range seeding. The main limitation is the hazard of erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and

tillage should be along the contour of the slope. The low annual precipitation should be of concern when reseeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## 250—Ziggy-Ucross-Oldwolf loams, 3 to 15 percent slopes

### Setting

**Elevation:** 4,300 to 4,800 feet

**Mean annual precipitation:** 15 to 17 inches

**Frost-free period:** 105 to 130 days

### Major Component Description

#### Ziggy and similar soils

Composition: 35 percent  
 Landform: Fan remnant, hill  
 Landform Element: Backslope, footslope  
 Slope: 0 to 6 percent  
 Depth to Restrictive Feature: None noted  
 Drainage Class: Well drained  
 Parent Material: Alluvium derived from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 5 inches; loam  
 Bw—5 to 14 inches; loam  
 Bk—14 to 60 inches; clay loam

**Note:** Permeability of the Ziggy soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is low. The hazard of water and wind erosion is moderate.

#### Ucross and similar soils

Composition: 30 percent  
 Landform: Hill, ridge  
 Landform Element: Summit, shoulder  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained

Parent Material: Alluvium over residuum weathered from sandstone and shale

Flooding: None

Water Table: No water table exists above a depth of 6 feet

Ponding: None

#### Typical profile:

A—0 to 5 inches; loam

Bk—5 to 31 inches; clay loam

Cr—31 to 60 inches; bedrock

**Note:** Permeability of the Ucross soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

#### Oldwolf and similar soils

Composition: 20 percent  
 Landform: Hill, ridge  
 Landform Element: Backslope, summit  
 Slope: 3 to 15 percent  
 Depth to Restrictive Feature: Bedrock (paralithic): 20 to 40 inches  
 Drainage Class: Well drained  
 Parent Material: Alluvium over residuum weathered from sandstone and shale  
 Flooding: None  
 Water Table: No water table exists above a depth of 6 feet  
 Ponding: None  
**Typical profile:**  
 A—0 to 3 inches; loam  
 Bt—3 to 21 inches; clay loam  
 Bk—21 to 32 inches; loam  
 Cr—32 to 60 inches; bedrock

**Note:** Permeability of the Oldwolf soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium. The hazard of water erosion is severe. The hazard of wind erosion is moderate.

Typical soil descriptions with range in characteristics are included, in alphabetical order, in the section Soil Series and Their Morphology.

### Additional Components

Cromack: 4 percent

Deekay: 4 percent

Fairburn: 4 percent

Areas with 0-3 percent slope: 3 percent

### **Use and Management**

This unit is used primarily as rangeland and wildlife habitat.

The Ziggy soil is moderately well suited for stockwater ponds. The main limitation is the moderate seepage potential. The Ucross and Oldwolf soils are poorly suited for stockwater ponds. The main limitation is depth to bedrock.

This unit is well suited for mechanical range renovation and moderately well suited for range

seeding. The main limitation for range seeding is the hazard of water erosion. To reduce the hazard of erosion, adequate residue must be maintained on the surface at all times until the seeding is established. If practical, renovation and tillage should be done along the contour of the slope. The low annual precipitation should be of concern when reseeding.

For general and detailed information about managing this map unit, see the following sections in Part II of this publication: Agronomy, Range, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

## Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
100	Aridic Ustorthents, saline, 0 to 4 percent slopes-----	1,548	*
101	Arvada, thick surface very fine sandy loam, 0 to 6 percent slopes-----	3,890	0.2
102	Arvada, thick surface-Arvada-Slickspots complex, 0 to 6 percent slopes---	36,028	2.0
103	Arwite fine sandy loam, 0 to 6 percent slopes-----	11,006	0.6
104	Arwite fine sandy loam, 6 to 15 percent slopes-----	2,257	0.1
105	Arwite-Elwop fine sandy loams, 0 to 6 percent slopes-----	6,623	0.4
106	Arwite-Elwop fine sandy loams, 6 to 15 percent slopes-----	7,885	0.4
107	Arwite-Vonalf fine sandy loams, 0 to 6 percent slopes-----	6,961	0.4
108	Arwite-Vonalf fine sandy loams, 6 to 15 percent slopes-----	2,684	0.1
109	Bidman loam, 0 to 6 percent slopes-----	9,374	0.5
110	Bidman loam, loamy substratum, 0 to 6 percent slopes-----	3,961	0.2
111	Bidman-Parmleed loams, 0 to 6 percent slopes-----	36,035	2.0
112	Bidman-Parmleed loams, 6 to 15 percent slopes-----	8,726	0.5
113	Bidman-Ulm loams, 0 to 6 percent slopes-----	26,627	1.5
114	Bowbac-Taluca-Badland complex, 3 to 20 percent slopes-----	1,074	*
115	Bowbac-Worf fine sandy loams, 3 to 15 percent slopes-----	2,420	0.1
116	Cambria-Kishona-Zigweid loams, 0 to 6 percent slopes-----	28,172	1.6
117	Cambria-Kishona-Zigweid loams, 6 to 15 percent slopes-----	11,599	0.6
118	Clarkelen-Draknab complex, 0 to 3 percent slopes-----	2,429	0.1
119	Clarkelen-Embry fine sandy loams, 0 to 4 percent slopes-----	5,139	0.3
120	Clarkelen-Keeline association, 0 to 6 percent slopes-----	2,316	0.1
121	Cushman-Cambria loams, 0 to 6 percent slopes-----	17,480	1.0
122	Cushman-Cambria loams, 6 to 15 percent slopes-----	21,127	1.2
123	Cushman-Renohill loams, 6 to 15 percent slopes-----	3,321	0.2
124	Cushman-Shingle loams, 6 to 15 percent slopes-----	9,295	0.5
125	Cushman-Terro complex, 6 to 15 percent slopes-----	311	*
126	Cushman-Theedle loams, 0 to 6 percent slopes-----	8,590	0.5
127	Cushman-Theedle loams, 6 to 15 percent slopes-----	12,765	0.7
128	Cushman-Worf loams, 3 to 15 percent slopes-----	10,501	0.6
129	Decolney-Hiland fine sandy loams, 0 to 6 percent slopes-----	16,891	0.9
130	Decolney-Hiland fine sandy loams, 6 to 15 percent slopes-----	2,923	0.2
131	Deekay loam, 0 to 6 percent slopes-----	5,801	0.3
132	Deekay-Moorhead loams, 0 to 6 percent slopes-----	11,431	0.6
133	Deekay-Moorhead loams, 6 to 15 percent slopes-----	2,251	0.1
134	Deekay-Oldwolf loams, 0 to 6 percent slopes-----	16,292	0.9
135	Deekay-Oldwolf loams, 6 to 15 percent slopes-----	14,117	0.8
136	Deekay-Ziggy loams, 0 to 6 percent slopes-----	5,027	0.3
137	Echeta clay loam, 0 to 6 percent slopes-----	2,075	0.1
138	Echeta-Cromack clay loams, 6 to 15 percent slopes-----	2,710	0.2
139	Embry-Orpha complex, 3 to 15 percent slopes-----	6,322	0.4
140	Embry-Taluca sandy loams, 3 to 20 percent slopes-----	3,100	0.2
141	Emigha loam, 0 to 3 percent slopes-----	2,538	0.1
142	Emigha, sodic-Arvada, thick surface complex, 0 to 4 percent slopes-----	4,190	0.2
143	Felix clay, ponded, 0 to 2 percent slopes-----	4,999	0.3
144	Forkwood loam, 0 to 6 percent slopes-----	17,180	1.0
145	Forkwood-Cambria loams, 0 to 6 percent slopes-----	27,808	1.6
146	Forkwood-Cushman loams, 0 to 6 percent slopes-----	93,833	5.2
147	Forkwood-Cushman loams, 6 to 15 percent slopes-----	52,821	2.9
148	Forkwood-Ulm loams, 0 to 6 percent slopes-----	42,956	2.4
149	Forkwood-Ulm loams, 6 to 15 percent slopes-----	5,313	0.3
150	Gateson-Taluca-Turnercrest complex, 6 to 30 percent slopes-----	11,461	0.6
151	Haverdad loam, 0 to 3 percent slopes-----	9,753	0.5
152	Haverdad-Clarkelen complex, 0 to 4 percent slopes-----	2,082	0.1
153	Haverdad-Kishona association, 0 to 6 percent slopes-----	11,770	0.7
154	Heldt clay loam, 0 to 6 percent slopes-----	4,048	0.2
155	Heldt-Bidman complex, saline, 0 to 3 percent slopes-----	3,411	0.2
156	Hiland fine sandy loam, 0 to 6 percent slopes-----	5,334	0.3
157	Hiland-Bowbac fine sandy loams, 0 to 6 percent slopes-----	60,415	3.4
158	Hiland-Bowbac fine sandy loams, 6 to 15 percent slopes-----	53,710	3.0
159	Hiland-Vonalee fine sandy loams, 0 to 6 percent slopes-----	12,405	0.7
160	Hiland-Vonalee fine sandy loams, 6 to 15 percent slopes-----	5,527	0.3

\* See footnote at end of table.

## Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
161	Hilight-Taluca, cool-Wags complex, 6 to 40 percent slopes-----	5,187	0.3
162	Lismas-Mittenbutte, cool-Sabatka complex, 6 to 40 percent slopes-----	2,965	0.2
163	Hilight-Wags-Badland complex, 3 to 45 percent slopes-----	80,864	4.5
164	Lismas-Sabatka-Badland complex, 3 to 45 percent slopes-----	6,967	0.4
165	Jayem fine sandy loam, 6 to 20 percent slopes-----	1,906	0.1
166	Jaywest loam, 0 to 6 percent slopes-----	4,668	0.3
167	Jaywest-Moorhead loams, 0 to 6 percent slopes-----	11,357	0.6
168	Jaywest-Spottedhorse loams, 0 to 6 percent slopes-----	8,484	0.5
169	Julesburg fine sandy loam, 0 to 6 percent slopes-----	1,225	*
170	Keeline-Tullock loamy sands, 6 to 30 percent slopes-----	13,678	0.8
171	Keeline-Tullock-Niobrara, dry complex, 3 to 30 percent slopes-----	10,236	0.6
172	Keyner fine sandy loam, 0 to 6 percent slopes-----	10,761	0.6
173	Lawver-Teckla-Wibaux complex, 0 to 6 percent slopes-----	6,217	0.3
174	Brislawn-Rockybutte-Ironbutte complex, 0 to 10 percent slopes-----	4,222	0.2
175	Lawver-Wibaux complex, 6 to 30 percent slopes-----	2,865	0.2
176	Leiter-Cromack clay loams, 3 to 15 percent slopes-----	1,839	0.1
177	Maysdorf fine sandy loam, 0 to 6 percent slopes-----	5,189	0.3
178	Maysdorf sandy clay loam, 0 to 6 percent slopes-----	701	*
179	Maysdorf-Pugsley sandy loams, 0 to 6 percent slopes-----	10,371	0.6
180	Maysdorf-Pugsley sandy loams, 6 to 15 percent slopes-----	6,226	0.3
181	Moorhead clay loam, 0 to 6 percent slopes-----	10,473	0.6
182	Moorhead loam, 0 to 6 percent slopes-----	2,209	0.1
183	Moorhead-Leiter clay loams, 0 to 6 percent slopes-----	8,315	0.5
184	Moorhead-Leiter clay loams, 6 to 15 percent slopes-----	8,574	0.5
185	Moskee fine sandy loam, 0 to 6 percent slopes-----	2,789	0.2
186	Moskee fine sandy loam, 6 to 10 percent slopes-----	124	*
187	Nuncho loam, 0 to 6 percent slopes-----	3,063	0.2
188	Orpha-Tullock loamy sands, 6 to 30 percent slopes-----	3,288	0.2
189	Oshoto-Moorhead loams, 0 to 6 percent slopes-----	2,109	0.1
190	Parmleed-Renohill complex, 3 to 15 percent slopes-----	5,154	0.3
191	Pits-Dumps complex-----	14,818	0.8
192	Platmak loam, 0 to 6 percent slopes-----	1,565	*
193	Pugsley-Decolney sandy loams, 0 to 6 percent slopes-----	1,304	*
194	Pugsley-Decolney sandy loams, 6 to 15 percent slopes-----	3,121	0.2
195	Rauzi fine sandy loam, 0 to 6 percent slopes-----	1,980	0.1
196	Rauzi sandy clay loam, 0 to 6 percent slopes-----	1,226	*
197	Rauzi-Elwop fine sandy loams, 2 to 10 percent slopes-----	3,041	0.2
198	Recluse loam, 0 to 6 percent slopes-----	1,458	*
199	Renohill-Savageton clay loams, 0 to 6 percent slopes-----	1,264	*
200	Renohill-Savageton clay loams, 6 to 15 percent slopes-----	2,747	0.2
201	Renohill-Shingle-Worf complex 3 to 15 percent slopes-----	4,458	0.2
202	Renohill-Worfka clay loams, 3 to 15 percent slopes-----	3,308	0.2
203	Rockypoint-Iwait association, 0 to 6 percent slopes-----	2,514	0.1
204	Samday-Samday, cool-Shingle clay loams, 6 to 40 percent slopes-----	7,685	0.4
205	Samday-Savageton clay loams, 3 to 15 percent slopes-----	7,108	0.4
206	Samday-Shingle-Badland complex, 10 to 45 percent slopes-----	16,975	0.9
207	Cromack-Fairburn-Ucross complex, 3 to 20 percent slopes-----	5,913	0.3
208	Savageton-Silhouette clay loams, 0 to 6 percent slopes-----	4,550	0.3
209	Savageton-Silhouette clay loams, 6 to 15 percent slopes-----	3,053	0.2
210	Shingle-Taluca complex, 3 to 30 percent slopes-----	11,667	0.7
211	Shingle-Worf loams, 3 to 30 percent slopes-----	10,117	0.6
212	Teckla very fine sandy loam, 0 to 10 percent slopes-----	2,445	0.1
213	Terro-Taluca sandy loams, 6 to 30 percent slopes-----	4,153	0.2
214	Theedle-Kishona loams, 0 to 6 percent slopes-----	37,258	2.1
215	Theedle-Kishona loams, 6 to 20 percent slopes-----	72,449	4.0
216	Theedle-Kishona-Shingle loams, 3 to 30 percent slopes-----	35,213	2.0
217	Theedle-Shingle loams, 3 to 30 percent slopes-----	105,717	5.9
218	Theedle-Turnercrest-Kishona complex, 3 to 15 percent slopes-----	10,481	0.6
219	Torriarents-Torriorthents complex, reclaimed-----	3,175	0.2
220	Pitchdraw-Ashollow-Niobrara complex, 3 to 30 percent slopes-----	8,099	0.5
221	Turnercrest-Keeline-Taluca fine sandy loams, 6 to 30 percent slopes-----	17,870	1.0
222	Turnercrest-Wibaux, thin solum-Taluca complex, 6 to 40 percent slopes----	1,258	*

\* See footnote at end of table.

## Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
223	Ucross loam, 1 to 9 percent slopes-----	2,562	0.1
224	Ucross-Iwait loams, 0 to 6 percent slopes-----	5,901	0.3
225	Ucross-Iwait-Fairburn loams, 3 to 30 percent slopes-----	25,650	1.4
226	Ulm loam, 0 to 6 percent slopes-----	8,024	0.4
227	Ulm clay loam, 0 to 6 percent slopes-----	18,642	1.0
228	Ulm-Renohill clay loams, 0 to 6 percent slopes-----	16,140	0.9
229	Ulm-Renohill clay loams, 6 to 15 percent slopes-----	3,707	0.2
230	Urban land-Deekay-Moorhead complex, 0 to 6 percent slopes-----	3,879	0.2
231	Urban land-Leiter-Moorhead complex, 3 to 10 percent slopes-----	779	*
232	Urban land-Pitchdraw-Ashollow complex, 6 to 15 percent slopes-----	604	*
233	Ustic Torriorthents, gullied-----	77,884	4.3
234	Ustic Torriorthents-Badland complex, 10 to 100 percent slopes-----	29,768	1.7
235	Vonalee fine sandy loam, 0 to 10 percent slopes-----	3,346	0.2
236	Vonalee-Terro fine sandy loams, 2 to 10 percent slopes-----	11,884	0.7
237	Vonalf fine sandy loam, 0 to 6 percent slopes-----	1,176	*
238	Vonalf-Xema fine sandy loams, 3 to 10 percent slopes-----	8,149	0.5
239	Ironbutte-Fairburn-Mittenbutte complex, 6 to 40 percent slopes-----	5,669	0.3
240	Wibaux-Wibaux, thin solum complex, 6 to 40 percent slopes-----	31,560	1.8
241	Ironbutte-Ironbutte, thin solum channery loams, 6 to 40 percent slopes---	6,837	0.4
242	Ironbutte-Deekay-Moorhead association, 3 to 30 percent slopes-----	9,328	0.5
243	Wibaux, thick solum-Wibaux channery fine sandy loams, 3 to 40 percent slopes-----	8,935	0.5
244	Muleherder-Ironbutte channery loams, 3 to 40 percent slopes-----	5,491	0.3
245	Wibaux-Shingle-Badland complex, 6 to 60 percent slopes-----	8,136	0.5
246	Wyarno-Ulm clay loams, 0 to 6 percent slopes-----	1,268	*
247	Wytite-Ulm loams, 0 to 6 percent slopes-----	2,226	0.1
248	Ziggy-Iwait loams, 0 to 6 percent slopes-----	6,924	0.4
249	Ziggy-Iwait loams, 6 to 15 percent slopes-----	2,207	0.1
250	Ziggy-Ucross-Oldwolf loams, 3 to 15 percent slopes-----	15,628	0.9
251	Water-----	285	*
	Total-----	1,793,243	100.0

\* Less than 0.1 percent.



# Formation and Classification of the Soils

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The soils in the survey area are the product of complex interrelated processes. They are the result of living organisms and climate acting on parent material that has a particular relief over a period of time. The role of each of these factors in the formation of the soils is explained in the paragraphs that follow. This is followed by a discussion of the processes of soil horizon differentiation.

## Factors of Soil Formation

### Parent Material

Parent material is the unconsolidated material from which soils form. Soils inherit many of their physical and chemical properties from their parent material. Parent materials accumulate from the weathering of underlying bedrock, from transportation of sediments by wind, water, or gravity, or by a combination of these agents.

The soils in the survey area formed primarily in sediments derived from the Fort Union and Wasatch Formations. These formations, comprised of interbedded sandstone and shale bedrock, are usually weakly consolidated and therefore susceptible to weathering and erosion. The parent materials from which soils formed in the survey area include residuum, alluvium, wind-deposited sediments, or a combination of these materials.

Soils on structural, or bedrock controlled, surfaces formed primarily in residuum. These surfaces include ridges, hills, breaks, and conical peaks. Soils formed in residuum typically exhibit properties similar to that of the underlying bedrock, and they commonly show minimal development. Taluce soils are shallow soils formed in residuum derived from sandstone; Samday soils are shallow soils formed in residuum derived from shale. Some developed soils formed in residuum. They occur on more stable structural surfaces, including broad upland ridges and buttes. Cushman and Renohill are examples of these kinds of soils.

Alluvium is material that has been transported downslope by moving water. The characteristics of

alluvium depend on the upsweep source rather than on the underlying geologic formation. If the source is mixed kinds of rock, the soils that form will exhibit differing kinds of qualities. For example, Bidman soils formed in alluvium derived primarily from shale, where Forkwood soils formed in alluvium derived from mixed sources, including sandstone and shale. Bidman soils have more clay in the subsoil and are less permeable than are Forkwood soils.

Alluvial deposits occur on a wide variety of landforms. The older landforms are typically on upland positions, including fan terraces, relict terraces, and lower hillslopes. These are relatively stable landscape positions on which strongly developed soils, such as Bidman and Parmleed, formed. Intermediate age landforms include the lower fan terraces, low terraces, and playas. The degree of soil development varies on these surfaces. Examples of soils which formed in alluvium on these landforms are the Cambria, Emigha, Felix, and Forkwood soils. Flood plains contain the youngest alluvial deposits in the survey area. Soils on flood plains, such as Clarkelen and Haverdad, exhibit little or no development.

Eolian deposits occur throughout the survey area. Eolian deposits are derived primarily from sandstone, but may come from other sandy sources such as recent alluvium. Sand that is not protected by vegetation is moved by the wind and deposited as dunes on the leeward side of rock outcroppings and streams. Soils formed in these deposits, such as Orpha and Tullock, exhibit minimal development. Some dunes on upland positions are relatively stable. Soils developed in these materials, such as Halide and Maysdorf, exhibit a distinct subsoil and have accumulations of fine clay particles overlying layers of calcium carbonate.

### Climate

Precipitation and temperature directly influence soil formation and development by their effect on the weathering of parent material, runoff and erosion, and the types of vegetation that can grow in a geographic area.

Precipitation provides the water necessary for soil formation. It alters the parent material and landscape in many ways. Water dissolves many minerals and contributes to chemical reactions. Some minerals are removed, and others are altered or translocated within the soil profile. Water also provides the energy to loosen and transport sediment. Given enough time, water will level the landscape, which in turn reduces slope gradients and leads to stabilization of the landscape.

Temperature influences the rate of chemical and biological reactions. Low temperatures allow frost action to disintegrate rock. Freezing and thawing influence soil structure. The length and rate of biological activity in soil is directly related to the length of time the air and soil is above a certain temperature.

### Relief

Relief is the relative change in elevation of a landform. It affects soil formation by determining the stability of a given landscape position. Substantial erosion of material removes the developing soils, whereas accumulation of material buries the developing soil. Generally, convex positions are more susceptible to erosion and concave positions are more susceptible to accumulation. Soils on steeper slopes are less stable than those on gentler slopes because they are more susceptible to erosion. Soils on ridges and steep hills generally exhibit less development than those on adjacent less sloping areas of hills and fan terraces. Conversely, soils that formed in depressions and in the lower lying areas of flood plains accumulate sediment faster than soil horizons can mature.

Other soil properties that are related to relief are soil temperature, soil moisture, and soil organic matter content. Soils on north- and east-facing slopes receive less direct sunlight than those on south- and west-facing slopes. As a result, these soils tend to be cooler and more moist. Some slopes also tend to accumulate snow. Plant cover is generally denser and more organic matter accumulates in the topsoil on the cooler slopes.

Jayem soils formed primarily as a result of relief. These soils occur on the leeward, or depositional sides of hills. They receive additional moisture from snowpack during the winter months which is available to plants in the spring. This additional moisture results in increased vegetative production which, in turn, results in increased organic matter returned to the soil.

### Plant and Animal Life

Plants and animals are significant contributors to soil formation and development. Plants convert mineral nutrients, light energy, and water into organic compounds that eventually enrich the soil. Animals use plants, and animal wastes and remains are incorporated into the soil. Plant roots and burrowing animals tend to disturb soil layers while enhancing the movement of water and air in soils.

Darkening of the original parent material by addition of organic matter is the first observable step in the formation of many soils. Some of the younger soils are distinguishable from their parent material solely by this addition. Grasses tend to encourage development of a darker-colored, thick topsoil than do trees, which tie up organic compounds.

Both macro- and microfauna disturb the soil by burrowing. Badgers, prairie dogs, and smaller rodents move large quantities of subsoil and underlying material toward the surface. Abandoned burrows are eventually filled with topsoil. Worms and insects make many small burrows that promote soil aeration and water movement. These small burrows are less destructive of the soil horizons than the burrows of the larger animals.

Gateson soils formed as a result of the combination of climate, relief, and plants. These soils formed under a canopy of ponderosa pine and juniper. These trees favor a cooler, more moist environment, similar to that found on the north- and east-facing slopes of the Rochelle Hills. In addition, the trees created their own environment or microclimate. They act as a windbreak, catching additional snowfall during the winter and spring, and provide shade, keeping soil temperatures cooler than normal for this area. These conditions favored the development of the Gateson soil.

### Time

Climate, relief, and plants and animals alter the parent material over a period of time. Time allows these factors to interact, and the relative influence of each varies considerably. Long periods of drought or excessive precipitation gradually alter the plant cover and the animal species that occupy the various habitats. Long periods of intense rainfall affect soil development by stripping away soil material, exposing parent material, or by burying developed soils. High populations of grazing animals can deplete plant cover and expose soils to accelerated erosion.

The youngest soils in the survey area are those on flood plains and on the steep slopes of breaks, dunes, escarpments, and ridges. These soils exhibit only a small amount of organic matter accumulation and have little or no structural development. Haverdad, Orpha, Wags, and Wibaux soils are examples of young soils.

Soils of intermediate maturity have higher organic matter accumulations, have a subsoil that is distinguishable by color or structure, and are either leached of, or have distinct accumulations of calcium carbonate. Silhouette and Zigweid soils are examples. These soils are thought to have developed under climatic conditions similar to those of the present time.

The next oldest soils have a distinct subsoil in which accumulations of fine clay particles overlie accumulation of calcium carbonate. Forkwood, Hiland, and Ulm soils are examples.

The oldest soils exhibit strong evidence of translocation and accumulation of fine clay within a 1-inch vertical distance at the upper boundary of the argillic horizon. The older the soil, the more likely it is that it was subject to higher precipitation during glacial periods. Bidman and Parmleed soils are examples.

Other factors being the same, the greater the length of time the parent material has been in place, the more development has taken place in the soil. For example, the Kishona, Zigweid, and Forkwood soils all formed in medium-textured sediments on nearly level to gently sloping surfaces. The minimal development of the Kishona soils, the intermediate development of the Zigweid soils, and the much stronger development of the Forkwood soils is directly proportional to the age of the position they occupy.

### Process of Horizon Formation

Individual soil horizons form as a result of the four basic processes of addition, removal, transfer, and transformation of substances in the soil. These processes act primarily on organic matter, soluble salts, carbonates, and silicate clay minerals.

Addition of organic matter to the surface layer and transformation of organic matter into humus are the most common processes involved in horizon development. The profile of most of the soils in this survey area has also been leached of salt by the downward movement of water. This leaching has also transferred calcium carbonate to varying depths in

the soil. Accumulations of deeply leached carbonates are most prominent in the lower part of the subsoil. Unless sodium is present, carbonates must be leached in order for clay to be translocated from the surface layer to the subsoil. This is because sodium disperses clay particles and carbonates inhibit dispersion. Significant movement of fine clay by water into the subsoil creates an argillic horizon. Extensive removal of clay from the surface layer creates an alluvial horizon that is nearly devoid of clay and organic matter.

Some clayey soils in nearly level areas have accumulations of sodium and soluble salts because all the surface water cannot percolate through the soil profile. A natric horizon occurs in these soils. In occasional flooded or ponded soils, oxidation and reduction transforms iron and forms redoximorphic features.

### Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1998 and 1999). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table, "Classification of the Soils," shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

**ORDER.** Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

**SUBORDER.** Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthent (*Orth*, meaning true or common, plus *ent*, from Entisol).

**GREAT GROUP.** Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder

and by a prefix that indicates a property of the soil. An example is Torriorthents (*Torri*, meaning hot and dry climate conditions, plus *orthents*, the suborder of the Entisols that are most common).

**SUBGROUP.** Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Ustic* identifies the subgroup that receives more precipitation than the one that typifies the great group. An example is Ustic Torriorthents.

**FAMILY.** Families are established within a subgroup on the basis of physical and chemical

properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, CEC activity class, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents.

**SERIES.** The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

The Kishona series is an example of a fine-loamy, mixed, superactive, calcareous Mesic Ustic Torriorthents.

## Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Absted-----	Fine, smectitic, mesic Haplic Ustic Natrargids
Aridic Ustorthents-----	Aridic Ustorthents
Arvada-----	Fine, smectitic, mesic Vertic Natrargids
Arwrite-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Ashollow-----	Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents
Bidman-----	Fine, smectitic, mesic Ustic Paleargids
Boruff-----	Fine, smectitic, calcareous, mesic Vertic Fluvaquents
Bowbac-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Brislawn-----	Fine, smectitic, mesic Aridic Paleustalfs
Cambria-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Clarkelen-----	Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torrifluents
*Clarkelen-----	Coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torrifluents
Cromack-----	Fine, smectitic, mesic Aridic Haplustepts
Cushman-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Decolney-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Deekay-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Draknab-----	Sandy, mixed, mesic Ustic Torrifluents
Echeta-----	Fine, smectitic, mesic Torrertic Haplustepts
Elwop-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Embry-----	Coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torriorthents
Emigha-----	Fine-silty, mixed, superactive, mesic Ustifluventic Haplocambids
Fairburn-----	Loamy, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthents
Felix-----	Very-fine, smectitic, mesic Aridic Epiaquerts
Forkwood-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Gateson-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Haverdad-----	Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torrifluents
Heldt-----	Fine, smectitic, mesic Ustertic Haplocambids
Hiland-----	Fine-loamy, mixed, superactive, mesic Ustic Calciargids
Hilight-----	Clayey, smectitic, nonacid, mesic, shallow Ustic Torriorthents
Ironbutte-----	Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Aridic Ustorthents
Iwait-----	Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents
Jayem-----	Coarse-loamy, mixed, superactive, mesic Aridic Haplustolls
Jaywest-----	Fine, smectitic, mesic Aridic Paleustalfs
Julesburg-----	Coarse-loamy, mixed, superactive, mesic Aridic Argiustolls
Keeline-----	Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents
Keyner-----	Fine-loamy, mixed, superactive, mesic Haplic Ustic Natrargids
Kishona-----	Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents
Lawver-----	Fine, smectitic, mesic Ustic Paleargids
Leiter-----	Fine, smectitic, mesic Aridic Haplustalfs
Lismas-----	Clayey, smectitic, nonacid, mesic, shallow Aridic Ustorthents
Maysdorf-----	Fine-loamy, mixed, superactive, mesic Ustic Calciargids
Mittenbutte-----	Loamy, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthents
*Mittenbutte-----	Loamy, mixed, superactive, nonacid, mesic, shallow Aridic Ustorthents
Moorhead-----	Fine, smectitic, mesic Aridic Haplustalfs
Moskee-----	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Muleherder-----	Loamy-skeletal over fragmental, mixed, superactive, mesic Aridic Haplustepts
Niobrara-----	Mixed, mesic, shallow Aridic Ustipsamments
*Niobrara-----	Mixed, mesic, shallow Aridic Ustipsamments
Nuncho-----	Fine, smectitic, mesic Aridic Argiustolls
Oldwolf-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Orpha-----	Mixed, mesic Ustic Torripsamments
Oshoto-----	Fine-silty, mixed, superactive, mesic Aridic Haplustalfs
Parmleed-----	Fine, smectitic, mesic Ustic Paleargids
Pitchdraw-----	Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents
Platmak-----	Fine, smectitic, mesic Aridic Paleustolls
Pugsley-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Rauzi-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Recluse-----	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Renohill-----	Fine, smectitic, mesic Ustic Haplargids

## Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Rockybutte-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Rockypoint-----	Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents
Sabatka-----	Fine, smectitic, mesic Aridic Haplustepts
Samday-----	Clayey, smectitic, calcareous, mesic, shallow Ustic Torriorthents
Samsil-----	Clayey, smectitic, calcareous, mesic, shallow Aridic Ustorthents
Savageton-----	Fine, smectitic, mesic Ustic Haplocambids
Shingle-----	Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents
Silhouette-----	Fine, smectitic, mesic Ustic Haplocambids
Sodawells-----	Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents
Spottedhorse-----	Fine, smectitic, mesic Aridic Paleustalfs
Taluce-----	Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents
*Taluce-----	Loamy, mixed, superactive, nonacid, mesic, shallow Ustic Torriorthents
Teckla-----	Fine-loamy, mixed, superactive, mesic Ustic Haplargids
Terro-----	Coarse-loamy, mixed, superactive, mesic Ustic Haplargids
Theedle-----	Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents
Torriarents-----	Torriarents
Torriorthents-----	Torriorthents
Tullock-----	Mixed, mesic Ustic Torripsamments
Turnercrest-----	Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents
*Turnercrest-----	Coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torriorthents
Ucross-----	Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents
Ulm-----	Fine, smectitic, mesic Ustic Haplargids
Ustic Torriorthents-----	Ustic Torriorthents
Valent-----	Mixed, mesic Aridic Ustipsamments
Vonalee-----	Coarse-loamy, mixed, superactive, mesic Ustic Haplargids
Vonalf-----	Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs
Wags-----	Fine, smectitic, nonacid, mesic Ustic Torriorthents
Wibaux-----	Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Ustic Torriorthents
*Wibaux-----	Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Ustic Torriorthents
Worf-----	Loamy, mixed, superactive, mesic, shallow Ustic Haplargids
Worfka-----	Clayey, smectitic, mesic, shallow Ustic Haplargids
Wyarno-----	Fine, smectitic, mesic Ustic Haplargids
Wytote-----	Fine-silty, mixed, superactive, mesic Ustic Haplargids
Xema-----	Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs
Ziggy-----	Fine-loamy, mixed, superactive, mesic Aridic Haplustepts
Zigweid-----	Fine-loamy, mixed, superactive, mesic Ustic Haplocambids

## Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1999) and in "Keys to Soil Taxonomy" (USDA, 1998). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

### Absted Series

The Absted series consists of very deep, well drained soils on alluvial fans, fan remnants, and stream terraces. The soils formed in alluvium derived from sodic shale. Slopes range from 0 to 6 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Haplic Ustic Natrargids

Typical pedon of Absted fine sandy loam, on a south-facing slope of about 1 percent under native grass vegetation; SE 1/4 of the NE 1/4 of section 32, T. 55 N., R. 79 W.; 44 degrees 42 minutes 49 seconds north latitude and 106 degrees 25 minutes 14 seconds west longitude.

E—0 to 2 inches; light gray (10YR 7/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong thick platy structure parting to strong thin platy; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; slightly alkaline (pH 7.6); abrupt smooth boundary.

Bt—2 to 8 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong medium and fine angular blocky; very hard, firm, sticky and plastic; few fine and medium roots; many prominent clay films on faces of peds; moderately alkaline (pH 8.2); clear smooth boundary.

Btkn—8 to 13 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; common distinct clay films on faces of peds; strongly effervescent; calcium carbonate and gypsum as common fine filaments and threads; strongly alkaline (pH 8.8); clear smooth boundary.

Bkn—13 to 60 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; many prominent threads of calcium carbonate and gypsum; very strongly alkaline (pH 9.0).

Depth to the natric horizon ranges from 6 to 24 inches. Depth to calcium carbonate ranges from 6 to 20 inches. Rock fragments range from 0 to 5 percent.

The Bt horizon texture is clay, clay loam, or silty clay loam. Reaction is slightly alkaline or moderately alkaline. Exchangeable sodium ranges from 5 to 10 percent. Electrical conductivity ranges from 2 to 5 millimhos per centimeter.

The Btkn horizon texture is clay, clay loam, or silty clay. Reaction is strongly or very strongly alkaline. Exchangeable sodium ranges from 15 to 30 percent. Electrical conductivity ranges from 8 to 16 millimhos per centimeter.

The Bkn horizon texture is clay, clay loam, or silty clay. Reaction is moderately alkaline to strongly alkaline. Exchangeable sodium ranges from 10 to 30 percent. Electrical conductivity ranges from 8 to 16 millimhos per centimeter.

## Aridic Ustorthents

Aridic Ustorthents consist of very deep, well drained soils on stream terraces. The soils formed in alluvium derived from sodic shale. Slopes range from 0 to 6 percent. Elevation is 4,200 to 4,810 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Aridic Ustorthents

Typical pedon of Aridic Ustorthents loam, in an area of Aridic Ustorthents loam, 0 to 6 percent slopes.

- A—0 to 2 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly alkaline (pH 7.8); abrupt smooth boundary.
- Bw—2 to 6 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine and medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; slightly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.
- By1—6 to 21 inches; brown (10YR 5/3) clay loam, stratified with loam, silty clay loam, and clay, brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine light gray (10YR 7/2) nests of gypsum throughout; slightly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.
- By2—21 to 46 inches; brown (10YR 5/3) clay loam, stratified with loam, silty clay loam, and clay, dark brown (10YR 3/3) moist; moderate fine and medium angular blocky structure; slightly hard, friable, moderately sticky and slightly plastic; common fine light gray (10YR 7/2) nests of gypsum throughout; slightly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.
- C—46 to 60 inches; brown (10YR 5/3) sandy clay loam, stratified with fine sandy loam, loam, and clay loam, brown (10YR 4/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; slightly effervescent; slightly alkaline (pH 7.4).

Depth to accumulations of calcium carbonate ranges from 3 to 13 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bw horizon texture is clay loam, silty clay loam, or sandy clay loam. Reaction is slightly or moderately alkaline. Electrical conductivity ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio ranges from 1 to 10.

The By horizon texture is clay loam, stratified with loam, silty clay loam, and clay. Reaction is slightly or moderately alkaline. Electrical conductivity ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio ranges from 1 to 13.

The C horizon texture is sandy clay loam, stratified with fine sandy loam, loam, and clay loam. Reaction is slightly or moderately alkaline. Electrical conductivity ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio ranges from 1 to 13.

## Arvada Series

The Arvada series consists of very deep, well drained soils on alluvial fans, fan remnants, and stream terraces. The soils formed in alluvium derived from sodic shale. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Vertic Natrargids

Typical pedon of Arvada fine sandy loam, in an area of Arvada, thick surface-Arvada-Slickspots complex, 0 to 6 percent slopes, about 340 feet west and 780 feet south of the northeast corner of section 36, T. 47 N., R. 71 W.

- E—0 to 2 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse platy structure parting to weak medium granular; soft, friable, nonsticky and nonplastic; many fine and very fine roots; slightly alkaline; abrupt smooth boundary.
- Btn—2 to 9 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate coarse and medium columnar structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; common fine and very fine roots; common prominent clay films on faces of peds; very strongly alkaline; clear wavy boundary.
- Btkn—9 to 15 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; very hard, firm,

sticky and plastic; few fine roots; common prominent clay films on faces of peds; slightly effervescent; many coarse and medium masses of calcium carbonate; strongly alkaline; clear wavy boundary.

Bkny1—15 to 24 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; strongly effervescent; common medium masses of calcium carbonate; strongly alkaline; clear wavy boundary.

Bkny2—24 to 44 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine roots; strongly effervescent; few medium and common fine filaments and masses of calcium carbonate and gypsum; strongly alkaline; clear wavy boundary.

C—44 to 60 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and plastic; few fine roots; strongly effervescent; calcium carbonate disseminated; strongly alkaline.

Depth to accumulations of calcium carbonate ranges from 2 to 13 inches. Depth to the natric horizon commonly ranges from 2 to 8 inches, but may extend to 15 inches in some pedons.

The E horizon texture is fine sandy loam, very fine sandy loam, or loam. Reaction is neutral to moderately alkaline.

Some pedons have a Bt horizon with texture of clay loam or silty clay loam. Reaction is slightly alkaline or moderately alkaline. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio ranges from 3 to 10.

The Btn horizon texture is clay loam, silty clay loam, silty clay, or clay. Reaction is strongly alkaline or very strongly alkaline. Electrical conductivity ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio ranges from 13 to 30.

The Btkn horizon texture is clay loam, silty clay loam, or clay. Reaction is moderately alkaline to very strongly alkaline. Electrical conductivity ranges from 4 to 12 millimhos per centimeter. Sodium adsorption ratio ranges from 13 to 30.

The Bkny and C horizon textures are clay loam, silty clay loam, or clay. Reaction is moderately alkaline to very strongly alkaline and electrical conductivity ranges from 8 to 16 millimhos per centimeter in both horizons. Sodium adsorption ratio ranges from 10 to 30 in the Bkny horizon and from 10 to 25 in the C horizon.

## Arwite Series

The Arwite series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Arwite fine sandy loam, from an area of Arwite-Elwop fine sandy loams, 6 to 15 percent slopes, about 1,800 feet west and 1,200 feet south of the northeast corner of section 13, T. 56 N., R. 74 W. USGS topographic quadrangle Homestead Draw, SW, Wyoming; 44 degrees 50 minutes 11 seconds north latitude and 105 degrees 42 minutes 16 seconds west longitude.

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; common fine interstitial pores throughout; neutral (pH 7.0); clear smooth boundary.

Bt1—5 to 14 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, moderately sticky and moderately plastic; common distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; many fine and very fine roots throughout; common fine tubular pores throughout; neutral (pH 7.2); clear wavy boundary.

Bt2—14 to 24 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, moderately sticky and moderately plastic; common distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; many fine and very fine roots throughout; common fine tubular pores throughout; neutral (pH 7.2); gradual wavy boundary.

Btk—24 to 32 inches; light olive brown (2.5Y 5/3) sandy clay loam, olive brown (10YR 4/3) moist; moderate medium angular blocky structure; slightly hard, friable, slightly sticky and slightly

plastic; many distinct discontinuous brown (10YR 4/3) clay films on faces of peds; common fine and very fine roots throughout; common fine tubular pores throughout; few fine light gray (10YR 7/2) irregular carbonate threads throughout; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

Bk1—32 to 45 inches; light olive brown (2.5Y 5/3) fine sandy loam, olive brown (2.5Y 4/3) moist; moderate medium angular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and very fine roots throughout; common fine vesicular pores throughout; few fine light gray (10YR 7/2) irregular carbonate threads throughout; slightly effervescent, moderately alkaline (pH 8.0); clear smooth boundary.

Bk2—45 to 60 inches; light olive brown (2.5Y 5/3) fine sandy loam, olive brown (2.5Y 4/3) moist; weak fine and medium angular blocky structure; slightly hard, friable; few fine and very fine roots throughout; few fine vesicular pores throughout; few fine light gray (10YR 7/2) irregular carbonate threads throughout; slightly effervescent; moderately alkaline (pH 8.0).

Depth to accumulations of carbonates is 25 to 40 inches.

Reaction in the A and Bt horizons is neutral or slightly alkaline. It is slightly alkaline or moderately alkaline in the Btk horizon.

The Bk horizon texture is fine sandy loam or sandy loam. Reaction is slightly alkaline or moderately alkaline.

## Ashollow Series

The Ashollow series consists of very deep, well drained, moderately rapidly permeable soils on hills and ridges. They formed in loamy and sandy residuum weathered from calcareous sandstone. Slopes range from 3 to 30 percent. Elevation is 4,300 to 5,200 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents

Typical pedon of Ashollow fine sandy loam, about 700 feet west and 2,300 feet south of the northeast corner of section 28, T. 55 N., R. 73 W.; USGS topographic quadrangle Recluse, WY; 44 degrees 42 minutes 51 seconds north latitude and 105 degrees 38 minutes 29 seconds west longitude.

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; common fine pores; slightly effervescent; carbonates are disseminated throughout; slightly alkaline; clear smooth boundary.

C1—5 to 28 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium angular blocky structure; loose, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; many fine pores; strongly effervescent; carbonates are disseminated throughout; moderately alkaline; gradual wavy boundary.

C2—28 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; loose, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; common fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; carbonates are disseminated throughout; strongly effervescent; moderately alkaline.

Depth to effervescent layers ranges from 0 to 10 inches.

Reaction in the A horizon is slightly alkaline or moderately alkaline.

The C horizon texture is sandy loam or fine sandy loam. Reaction is slightly alkaline or moderately alkaline.

## Bidman Series

The Bidman series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from shale. Slopes range from 0 to 10 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Paleargids

Typical pedon of Bidman loam, 0 to 6 percent slopes, about 330 feet east and 250 feet south of the northwest corner of section 1, T. 43 N., R. 76 W.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, brown (10YR 4/3) moist; weak medium platy structure parting to weak medium granular; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

- Bt—2 to 21 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium prismatic structure parting to moderate medium angular blocky; slightly hard, very friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; slightly alkaline; clear wavy boundary.
- Btk—21 to 28 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; strong coarse prismatic structure parting to moderate medium angular blocky; slightly hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark grayish brown (2.5Y 4/2) clay films on faces of peds; common fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; moderately alkaline; gradual wavy boundary.
- Bk1—28 to 48 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse angular blocky structure; extremely hard, very firm, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Bk2—48 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

Depth to continuous accumulations of calcium carbonate ranges from 8 to 27 inches.

Reaction in the E horizon is slightly acid to slightly alkaline.

The Bt horizon texture is clay loam or clay. Reaction is neutral or slightly alkaline. In the saline map unit, the reaction is slightly alkaline or moderately alkaline, the sodium adsorption ratio is 5 to 10 percent, and the electrical conductivity is 4 to 8 millimhos per centimeter.

The Btk horizon texture is clay loam or clay. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon texture is clay loam, clay, or loam. Reaction is moderately alkaline or strongly alkaline. In the saline phase, the sodium adsorption ratio is 5 to 10 percent and the electrical conductivity is 8 to 16 millimhos per centimeter.

The 2C horizon texture, in the loamy substratum phase, is sandy clay loam or sandy loam. Reaction is

moderately alkaline or strongly alkaline. Electrical conductivity is 0 to 2 millimhos per centimeter.

## Boruff Series

The Boruff series consists of very deep, poorly and somewhat poorly drained soils on flood plains and stream terraces. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 3 percent. Elevation is 4,100 to 4,800 feet. Flooding is rare to frequent for very brief or brief periods. Water table is from 0.5 to 1.5 feet. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, calcareous, mesic Vertic Fluvaquents

Typical pedon of Boruff silty clay on a west-facing slope of 1 percent in rangeland, about 900 feet east and 2,300 feet north of the southwest corner of section 9, T. 75 N., R. 55 W.; USGS topographic quadrangle Kline Draw, WY; 44 degrees 45 minutes 23 seconds north latitude and 105 degrees 54 minutes 1 second west longitude.

- A—0 to 2 inches; olive brown (2.5Y 4/3) silty clay, dark olive brown (2.5Y 3/3) moist; common fine distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; moderate fine and medium granular structure; slightly hard, friable, moderately sticky and moderately plastic; many very fine and common medium roots throughout; many fine pores; slightly effervescent; slightly alkaline; EC of 3.5; abrupt smooth boundary.
- C1—2 to 6 inches; stratified light yellowish brown (2.5Y 6/3) silty clay, light olive brown (2.5Y 5/3) and olive brown (2.5Y 4/3) moist; common fine distinct gray (N 6/0) redoximorphic depletions; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; common very fine and medium roots throughout; many fine pores; few distinct discontinuous dark brown (10YR 3/3) organic coats in root channels and/or pores; common fine irregular white (10YR 8/1) nests of gypsum throughout; slightly effervescent; moderately alkaline; EC of 5; abrupt wavy boundary.
- C2—6 to 46 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; stratified with thin layers of silty clay loam, clay

loam, silt loam, and fine sandy loam; many fine distinct gray (N 5/0) redoximorphic depletions; many fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; massive; hard, friable, slightly sticky and moderately plastic; common very fine roots throughout; many fine pores; few fine rounded white (10YR 8/1) nests of gypsum throughout; slightly effervescent; moderately alkaline; EC of 6; clear wavy boundary.

C3—46 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; stratified with thin layers of silty clay loam, clay loam, silt loam, and fine sandy loam; many fine and medium distinct gray (N 5/0) redoximorphic depletions; many fine and medium distinct light olive brown (2.5Y 5/6) and common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; massive; hard, friable, moderately sticky and moderately plastic; common very fine roots throughout; many fine pores; few fine rounded white (10YR 8/1) nests of gypsum throughout; slightly effervescent; EC of 5.5; moderately alkaline.

Depth to calcium carbonate ranges from 8 to 27 inches. Redoximorphic depletions and concentrations are common in the upper 18 inches.

Reaction in the A horizon is neutral to moderately alkaline. Electrical conductivity is 2 to 4 millimhos per centimeter.

The C horizon texture is silty clay, silty clay loam, or clay loam, stratified with very fine sandy loam, fine sandy loam, sandy loam, loam, silt loam, and loamy fine sand. Reaction is slightly alkaline to strongly alkaline. Electrical conductivity is 4 to 8 millimhos per centimeter.

## Bowbac Series

The Bowbac series consists of moderately deep, well drained soils on ridges, buttes, and hills. The soils formed in eolian deposits and residuum derived from sandstone. Slopes range from 0 to 15 percent. Elevation is 4,100 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Bowbac fine sandy loam, in an area of Hiland-Bowbac fine sandy loams, 0 to 6

percent slopes, about 1,250 feet north and 1,350 feet west of the southeast corner of section 23, T. 42 N., R. 72 W.; 43 degrees 35 minutes 45 seconds north latitude and 105 degrees 28 minutes 5 seconds west longitude.

A—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine and few medium and coarse roots; neutral; abrupt wavy boundary.

Bt1—3 to 25 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting to strong coarse and medium angular blocky; hard, friable, slightly sticky and moderately plastic; common fine and very fine and few coarse and medium roots; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—25 to 31 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium fine and very fine roots; common distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk—31 to 39 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and slightly plastic; few medium, fine, and very fine roots; slightly effervescent; few medium and fine masses of calcium carbonate; moderately alkaline; abrupt smooth boundary.

Cr—39 to 60 inches; slightly hard, slightly effervescent sandstone.

Depth to accumulations of calcium carbonate ranges from 10 to 31 inches. Depth to bedrock ranges from 20 to 40 inches.

The A horizon texture is fine sandy loam or sandy loam. Reaction is neutral or slightly alkaline.

Reaction in the Bt horizon is neutral or slightly alkaline.

The Bk horizon texture is sandy loam or fine sandy loam.

## Brislawn Series

The Brislawn series consists of very deep, well drained soils on plateaus and ridges. These soils

formed in alluvium or eolian deposits over weathered porcelanite. Slopes range from 0 to 6 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 46 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Paleustalfs

Typical pedon of Brislawn loam, in an area of Brislawn-Rockybutte-Ironbutte complex, 0 to 10 percent slopes, about 1,100 feet east and 400 feet south of the northwest corner of section 18, T. 56 N., R. 71 W.; USGS topographic quadrangle Rocky Butte SW, WY; 44 degrees 50 minutes 35 seconds north latitude and 105 degrees 26 minutes 56 seconds west longitude.

E—0 to 6 inches; brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) moist; weak thin platy structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; common fine pores; 2 percent subangular porcelanite channers; neutral; (pH 6.6); abrupt smooth boundary

Bt1—6 to 14 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; strong medium and coarse prismatic structure parting to strong fine and medium angular blocky; hard, firm, very sticky and very plastic; common very fine and fine roots throughout; common fine pores; many distinct discontinuous dark reddish brown (5YR 3/3) clay films on faces of peds; 5 percent subangular porcelanite channers; neutral; (pH 7.2); clear wavy boundary.

Bt2—14 to 21 inches; brown (7.5YR 4/3) clay, dark brown (7.5YR 3/3) moist; strong medium and coarse prismatic structure parting to moderate fine and medium angular blocky; hard, firm, very sticky and very plastic; common very fine and fine roots throughout; common fine pores; many distinct discontinuous dark brown (7.5YR 3/2) clay films on faces of peds; 5 percent subangular porcelanite channers; slightly alkaline; (pH 7.6); clear wavy boundary.

2Btk—21 to 31 inches; brown (7.5YR 4/4) channery clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; common very fine and fine roots throughout; common fine pores; common distinct discontinuous dark brown (7.5YR 3/3)

clay films on faces of peds; few fine irregular light gray (10YR 7/2) carbonate threads throughout; 15 percent subangular porcelanite channers; strongly effervescent; moderately alkaline; (pH 8.0); gradual wavy boundary.

2Bk—31 to 37 inches; brown (7.5YR 5/4) very channery clay loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, moderately sticky and moderately plastic; few very fine and fine roots throughout; few fine pores; few distinct discontinuous light gray (10YR 7/2) carbonate coats on bottom surfaces of rock fragments; few fine irregular light gray (10YR 7/2) carbonate threads; carbonates are disseminated throughout; strongly effervescent; 40 percent angular porcelanite channers; moderately alkaline; (pH 8.2); clear wavy boundary.

3C—37 to 60 inches; fractured porcelanite with 8 percent interstices or voids filled with light brown (7.5YR 6/4) sandy loam, brown (7.5YR 5/4) moist; common distinct discontinuous light gray (10YR 7/2) carbonate coats on bottom surfaces of rock fragments; slightly effervescent, fine earth material has variable effervescence; 70 percent angular porcelanite channers, 17 percent subangular flagstones, and 5 percent subrounded stones; slightly alkaline.

Depth to accumulations of calcium carbonate ranges from 15 to 28 inches. Depth to strongly contrasting particle size ranges from 20 to 40 inches.

The E horizon has rock fragments that range from 0 to 14 percent. Reaction is slight acid or neutral.

The Bt horizon texture is clay loam or clay. Rock fragments range from 0 to 14 percent porcelanite channers, but some subhorizons may be modified by up to 25 percent channers. Reaction is neutral or slightly alkaline.

The 2Btk horizon texture is clay or clay loam. Rock fragments range from 15 to 50 percent porcelanite channers. Reaction is slightly alkaline or moderately alkaline.

The 2Bk horizon texture is loam or clay. Rock fragments range from 25 to 65 percent porcelanite channers and 0 to 10 percent flagstones.

The 3C horizon texture is fractured porcelanite with less than 10 percent of interstices or voids filled with loam, sandy loam, or loamy sand. Rock fragments range from 60 to 95 percent channers, 0 to 15 percent flagstones, and 0 to 5 percent stones. Reaction is slightly acid to slightly alkaline.

## Cambria Series

The Cambria series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Cambria loam, in an area of Cushman-Cambria loams, 0 to 6 percent slopes, about 1,320 feet east and 2,620 feet south of northwest corner of section 15, T. 44 N., R. 75 W.

A—0 to 2 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium platy structure parting to weak medium and moderate fine granular; soft, friable, nonsticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

Bt—2 to 6 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; strong fine prismatic structure parting to strong medium and fine angular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many faint and common prominent clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

Btk—6 to 12 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium and fine prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few faint clay films on faces of peds; strongly effervescent; few medium and fine irregularly shaped masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Bk1—12 to 32 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; strongly effervescent; few medium and many fine filaments and threads of calcium carbonate; moderately alkaline; gradual wavy boundary.

Bk2—32 to 60 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent;

common fine masses of calcium carbonate; strongly alkaline.

Depth to accumulations of calcium carbonate ranges from 3 to 10 inches.

The Bt, Btk, and Bk horizon textures are loam or clay loam. Reaction is neutral or slightly alkaline in the Bt horizon.

## Clarkelen Series

The Clarkelen series consists of very deep, well drained soils on flood plains and stream terraces. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 4 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torrfluvents

Typical pedon of Clarkelen very fine sandy loam, in an area of Clarkelen-Keeline association, 0 to 6 percent slopes, about 30 feet north and 200 feet east of the southwest corner of section 25, T. 43 N., R. 76 W.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium and fine platy structure parting to weak fine and very fine granular; soft, friable, nonsticky and nonplastic; few coarse and medium and many fine and very fine roots; slightly effervescent; calcium carbonate disseminated; slightly alkaline; clear smooth boundary.

C1—3 to 31 inches; light brownish gray (2.5Y 6/2) fine sandy loam stratified with thin layers of sandy loam, very fine sandy loam, and loam, olive brown (2.5Y 4/4) moist; massive; soft, friable, nonsticky and nonplastic; few coarse and medium and common fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear smooth boundary.

C2—31 to 60 inches; pale brown (10YR 6/3) sandy loam stratified with thin layers of loamy fine sand, fine sandy loam, and very fine sandy loam, brown (10YR 4/3) moist; few fine strong brown (7.5YR 5/6 and 7.5YR 4/6) redoximorphic concentrations; massive; soft, very friable, nonsticky and nonplastic; few medium and common fine and

very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline.

The soils are commonly effervescent to the surface but may be noneffervescent to 8 inches in some pedons.

The A horizon texture is fine sandy loam or very fine sandy loam. Reaction is slightly alkaline or moderately alkaline.

The C horizon texture is sandy loam or fine sandy loam, and is stratified with thin layers of loamy sand, loamy fine sand, very fine sandy loam, and loam.

**Note:** The Clarkelen soil in map unit 119 is a taxadjunct to the Clarkelen series. The soil in this map unit is noneffervescent throughout. Reaction in the A horizon is slightly acid or neutral. Reaction in the C horizon is slightly acid through slightly alkaline. This soil is classified as coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torrifuvents.

## Cromack Series

The Cromack series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium over residuum derived from shale. Slopes range from 3 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Haplustepts

Typical pedon of Cromack clay loam, about 2,250 feet east and 750 feet north of the southwest corner of section 5, T. 56 N., R. 73 W.; USGS topographic quadrangle Homestead Draw SW, WY; 44 degrees 51 minutes 30 seconds north latitude and 105 degrees 40 minutes 9 seconds west longitude.

A—0 to 6 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; moderate fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, moderately sticky and moderately plastic; carbonates are disseminated throughout; slightly effervescent; 1 percent angular shale chips; slightly alkaline; clear smooth boundary.

Bw—6 to 14 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; strong fine and medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; carbonates disseminated throughout;

strongly effervescent; 1 percent angular shale chips; moderately alkaline; gradual wavy boundary.

Bk—14 to 29 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; strong medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common fine rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; 1 percent angular shale chips; moderately alkaline; clear wavy boundary.

Cr—29 to 60 inches; pale yellow (2.5Y 7/3) soft calcareous shale, light yellowish brown (2.5Y 6/3) moist.

Depth to bedrock ranges from 20 to 40 inches. Depth to continuous accumulations of carbonate ranges from 0 to 10 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The Bw and Bk horizon textures are clay or clay loam. Reaction is slightly alkaline or moderately alkaline in the Bw horizon.

## Cushman Series

The Cushman series consists of moderately deep, well drained soils on ridges, hills, and buttes. The soils formed in alluvium and residuum derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Cushman loam, in an area of Cushman-Theedle loams, 0 to 6 percent slopes, about 2,000 feet south and 2,050 feet west of the northeast corner of section 10, T. 47 N., R. 71 W.

A—0 to 2 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—2 to 11 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; many faint clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bt2—11 to 19 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, friable, sticky and plastic; common fine roots; many prominent clay films on faces of peds; slightly alkaline; clear smooth boundary.

Btk—19 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, friable, sticky and plastic; few fine and very fine roots; few faint clay films on faces of peds; violently effervescent; common medium irregularly shaped filaments and threads of calcium carbonate; moderately alkaline; abrupt smooth boundary.

Bk—23 to 30 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; violently effervescent; common medium irregularly shaped filaments and threads of calcium carbonate; moderately alkaline; abrupt smooth boundary.

Cr—30 to 60 inches; soft, effervescent shale.

Depth to accumulations of calcium carbonate ranges from 10 to 26 inches. Depth to bedrock ranges from 20 to 40 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bt, Btk, and Bk horizon textures are loam or clay loam. Reaction is neutral or slightly alkaline in the Bt horizon and moderately alkaline or strongly alkaline in the Bk horizon.

## Decolney Series

The Decolney series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Decolney fine sandy loam, in an area of Decolney-Hiland fine sandy loams, 0 to 6 percent slopes, 2,300 feet east and 2,000 feet south of the northwest corner of section 7, T. 41 N., R. 71 W.; USGS topographic quadrangle Teckla SW, WY; 42 degrees 32 minutes 34 seconds north latitude and 105 degrees 26 minutes 0 seconds west longitude.

A—0 to 3 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; slightly alkaline (pH 7.6); abrupt smooth boundary.

Bt1—3 to 14 inches; dark yellowish brown (10YR 4/4) sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and lining pores; slightly alkaline (pH 7.8); clear wavy boundary.

Bt2—14 to 22 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline (pH 7.8); clear wavy boundary.

C1—22 to 43 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots throughout; moderately alkaline (pH 7.9); abrupt wavy boundary.

C2—43 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots throughout; strongly effervescent; calcium carbonate disseminated; moderately alkaline (pH 8.4).

Depth to accumulations of calcium carbonate is 40 to 60 inches or more.

Reaction in the Bt horizon is neutral or slightly alkaline.

The C horizon texture is fine sandy loam or sandy loam. Reaction is slightly alkaline or moderately alkaline.

## Deekay Series

The Deekay series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Deekay loam, in an area of Deekay-Moorhead loams, 0 to 6 percent slopes, about 150 feet north and 1,700 feet east of the southwest corner of section 31, T. 49 N., R. 72 W.

- A—0 to 4 inches; grayish brown (10YR 5/2) loam, brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots throughout; neutral; clear wavy boundary.
- Bt1—4 to 8 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots throughout; few distinct discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; neutral; clear wavy boundary.
- Bt2—8 to 18 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; slightly hard, friable, moderately sticky and moderately plastic; many very fine and fine and common medium roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; slightly alkaline; clear wavy boundary.
- Btk—18 to 24 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, moderately sticky and slightly plastic; many very fine and fine and common medium roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; slightly effervescent; moderately alkaline; gradual wavy boundary.
- Bk—24 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; many fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

Depth to accumulations of calcium carbonate ranges from 10 to 30 inches.

The Bt, Btk, and Bk horizon textures are loam or clay loam. Reaction is neutral or slightly alkaline in

the Bt horizon and slightly alkaline or moderately alkaline in the Btk horizon.

## Draknab Series

The Draknab series consists of very deep, excessively drained soils on flood plains and stream terraces. The soils formed in stratified alluvium derived from sandstone. Slopes range from 0 to 3 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Sandy, mixed, mesic Ustic Torrifluvents

Typical pedon of Draknab sandy loam, in an area of Clarkelen-Draknab complex, 0 to 3 percent slopes, about 925 feet west and 950 feet north of the southeast corner of section 24, T. 41 N., R. 72 W.

- A—0 to 4 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to single grain; soft, very friable, nonsticky and nonplastic; many medium, fine, and very fine roots; slightly alkaline; clear wavy boundary.
- C1—4 to 28 inches; brown (10YR 5/3) loamy sand, stratified with thin layers of sandy loam and fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; slightly alkaline; clear wavy boundary.
- C2—28 to 36 inches; pale brown (10YR 6/3) sand, stratified with thin layers of loamy sand and sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; slightly alkaline; clear wavy boundary.
- C3—36 to 60 inches; pale brown (10YR 6/3) sand, stratified with thin layers of loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; slightly alkaline.

The soils are commonly noneffervescent throughout, but may be slightly effervescent below 10 inches in some pedons.

Reaction in the A horizon is neutral or slightly alkaline.

The C horizon texture averages loamy sand or sand and is stratified with thin layers of sandy loam and fine sandy loam. Reaction is slightly alkaline or moderately alkaline.

**Note:** The Draknab soils in this survey area are

outside the characteristics of the Draknab series. The soils are noneffervescent throughout. This does not affect use, management, or interpretations of this soil.

## Echeta Series

The Echeta series consists of very deep, well drained soils on alluvial fans, fan remnants, hills and ridges. The soils formed in alluvium derived primarily from shale. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Torricalf Haplustepts

Typical pedon of Echeta clay loam, in an area of Echeta-Cromack clay loams, 6 to 15 percent slopes, about 340 feet east and 750 feet north of the southwest corner of section 1, T. 50 N., R. 73 W.; USGS topographic quadrangle Gillette West, WY; 44 degrees 20 minutes 8 seconds north latitude and 105 degrees 35 minutes 20 seconds west longitude.

A—0 to 3 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong fine granular structure; slightly hard, firm, moderately sticky and moderately plastic; many very fine and fine and common medium and coarse roots throughout; carbonates are disseminated throughout; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw1—3 to 7 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; many very fine and fine and common medium and coarse roots throughout; carbonates are disseminated throughout; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw2—7 to 15 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate medium and coarse angular blocky; very hard, very firm, very sticky and very plastic; many very fine and fine and common medium and coarse roots throughout; carbonates are disseminated throughout; slightly effervescent; moderately alkaline; clear wavy boundary.

Bk1—15 to 37 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak

medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common very fine to medium roots throughout; common fine and medium irregular light gray (10YR 7/2) carbonate threads throughout and common fine and medium rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—37 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; common very fine and fine roots throughout; common fine and medium irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

Depth to effervescent layers ranges from 0 to 10 inches. Cracks .25 to .75 inches wide extend from the surface to 25 inches in some pedons when the soils are dry.

Reaction in the A horizon is neutral or slightly alkaline.

The Bw and Bk horizon textures are clay loam or clay. Reaction is slightly alkaline or moderately alkaline in the Bw horizon.

## Elwop Series

The Elwop series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium or eolian deposits over residuum derived from mixed sedimentary sources. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Elwop fine sandy loam, in an area of Arwite-Elwop sandy loams, 0 to 6 percent slopes, about 500 feet west and 2,300 feet north of the southeast corner of section 7, T. 48 N., R. 71 W.; USGS topographic quadrangle The Gap, WY; 44 degrees 9 minutes 6 seconds north latitude and 105 degrees 25 minutes 31 seconds west longitude.

A—0 to 4 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; neutral; clear smooth boundary.

Bt1—4 to 14 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; neutral; clear smooth boundary.

Bt2—14 to 24 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak fine and medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline; clear wavy boundary.

Bk—24 to 35 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; carbonates are disseminated throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr—35 to 60 inches; soft calcareous sandstone.

Depth to bedrock ranges from 20 to 40 inches.

Depth to calcium carbonate is 12 to 34 inches.

Reaction in the Bt horizon is neutral or slightly alkaline.

The Bk horizon texture is fine sandy loam and sandy loam.

## Embry Series

The Embry series consists of very deep, well drained soils on dunes, stream terraces, ridges, and hills. The soils formed in alluvium and eolian deposits derived from sandstone. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torriorthents

Typical pedon of Embry sandy loam, in an area of Embry-Taluca sandy loams, 3 to 20 percent slopes, about 2,320 feet north and 2,600 feet east of the southwest corner of section 4, T. 43 N., R. 69 W.

A—0 to 6 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary.

AC—6 to 12 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; neutral; gradual wavy boundary.

C1—12 to 36 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and common very fine roots; slightly alkaline; gradual wavy boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; slightly alkaline.

The A horizon texture is sandy loam or fine sandy loam.

The C horizon texture is fine sandy loam and sandy loam. Reaction is neutral or slightly alkaline.

## Emigha Series

The Emigha series consists of very deep, well drained soils on stream terraces. The soils formed in alluvium derived from silty shale. Slopes range from 0 to 4 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-silty, mixed, superactive, mesic Ustifluventic Haplocambids

Typical pedon of Emigha loam, 0 to 3 percent slopes, about 550 feet north and 1,320 feet east of the southwest corner of section 31, T. 46 N., R. 73 W.; 43 degrees 54 minutes 47 seconds north latitude and 105 degrees 41 minutes 4 seconds west longitude.

A—0 to 1 inch; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine platy structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly alkaline; abrupt smooth boundary.

Bw1—1 to 8 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium and fine prismatic structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear smooth boundary.

Bw2—8 to 19 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate medium and fine prismatic structure parting to weak fine

subangular blocky; slightly hard, friable, sticky and plastic; common fine and very fine roots; slightly effervescent; few fine seams and masses of calcium carbonate; strongly alkaline; clear smooth boundary.

Bk1—19 to 30 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, sticky and plastic; few fine and very fine roots; strongly effervescent; common fine seams and masses of calcium carbonate; strongly alkaline; gradual wavy boundary.

Bk2—30 to 60 inches; pale brown (10YR 6/3) clay loam stratified with thin layers of silt loam, silty clay loam, and loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, sticky and plastic; few very fine roots; strongly effervescent; many fine seams and masses of calcium carbonate; moderately alkaline.

Depth to stratified layers ranges from 11 to 30 inches. Depth to effervescent horizons ranges from 0 to 3 inches.

The A horizon texture is loam or silty clay loam.

The Bw horizon texture is silty clay loam or clay. Reaction is moderately alkaline or strongly alkaline. Electrical conductivity ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio ranges from 1 to 13.

**Note:** A Bn horizon occurs in place of the Bw horizon in the sodic map unit. Reaction is strongly alkaline or very strongly alkaline. Electrical conductivity ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio ranges from 13 to 30.

The Bk horizon texture is silty clay loam or clay loam; stratifications of loam, silt loam, and silty clay occur irregularly in the lower part of this horizon. Reaction is moderately alkaline or strongly alkaline. Electrical conductivity ranges from 4 to 8 millimhos per centimeter. Sodium adsorption ratio ranges from 1 to 13.

**Note:** A Bkn horizon occurs in place of the Bk horizon in the sodic map unit. Reaction is very strongly alkaline. Electrical conductivity ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio ranges from 13 to 25.

### Fairburn Series

The Fairburn series consists of shallow, well drained soils on hills and ridges. The soils formed in residuum derived from shale and sandstone. Slopes

range from 3 to 60 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthents

Typical pedon of Fairburn loam, in an area of Ucross-Iwait-Fairburn loams, 3 to 30 percent slopes, about 2,700 feet east and 2,200 feet south of the northwest corner of section 23, T. 56 N., R. 74 W.; USGS topographic quadrangle Homestead Draw SW, WY; 44 degrees 48 minutes 32 seconds north latitude and 105 degrees 42 minutes 52 seconds west longitude.

A—0 to 4 inches; light olive brown (2.5Y 5/3) loam, olive brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots throughout; common very fine and fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C—4 to 15 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots throughout; many very fine and fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; 2 percent gravel; moderately alkaline; abrupt wavy boundary.

Cr—15 to 60 inches; soft shale interbedded with sandstone.

Depth to bedrock is 10 to 20 inches. Depth to calcium carbonate is 0 to 4 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The C horizon texture is clay loam or loam. Rock fragments range from 0 to 15 percent. Reaction is slightly alkaline to moderately alkaline.

### Felix Series

The Felix series consists of very deep, poorly drained soils in depressions and playas. The soils formed in local alluvium derived from shale. Slopes range from 0 to 2 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Very fine, smectitic, mesic Aridic Epiaquerts

Typical pedon of Felix clay, ponded, about 2,200 feet east and 800 feet south of the northwest corner of section 10, T. 55 N., R. 73 W.; USGS topographic quadrangle Homestead Draw SW, WY; 44 degrees 45 minutes 57 seconds north latitude and 105 degrees 37 minutes 40 seconds west longitude

- A—0 to 2 inches; dark gray (5Y 4/1) clay, gray (5Y 6/1) dry; common fine and medium prominent strong brown (7.5YR 4/6) redoximorphic concentrations; strong fine and medium angular blocky structure; very hard, very firm, very sticky and very plastic; many very fine roots throughout; common very fine tubular pores; neutral; clear wavy boundary.
- BA—2 to 5 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry (B), dark gray (5Y 4/1), gray (5Y 6/1) dry (E); common fine prominent strong brown (7.5YR 4/6) and few medium prominent brown (7.5YR 4/4) redoximorphic concentrations; strong medium prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots throughout; common very fine tubular pores; few distinct discontinuous gray (5Y 6/1) skeletons on faces of peds; neutral; clear wavy boundary.
- Bss1—5 to 20 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry; common fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; strong coarse prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots throughout; common very fine tubular pores; few distinct continuous black (5Y 2/1) intersecting slickensides throughout; neutral; clear wavy boundary.
- Bss2—20 to 30 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; strong coarse prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots throughout; many very fine tubular pores; few distinct discontinuous very dark gray (5Y 3/1) intersecting slickensides throughout; neutral; gradual wavy boundary.
- By—30 to 50 inches; dark olive gray (5Y 3/2) clay, olive gray (5Y 4/2) dry; common fine prominent strong brown (7.5YR 5/8) redoximorphic

concentrations; weak very coarse prismatic structure parting to moderate fine and medium angular blocky; hard, friable, very sticky and very plastic; common very fine and fine roots throughout; many very fine tubular pores; common fine and medium irregular light gray (10YR 7/2) masses of gypsum throughout; very slightly effervescent; moderately alkaline; clear wavy boundary.

- Bky—50 to 60 inches; very dark grayish brown (2.5Y 3/2) clay, dark grayish brown (2.5Y 4/2) dry; moderate medium and coarse prismatic structure parting to moderate fine and medium angular blocky; hard, friable, very sticky and very plastic; common very fine and fine roots throughout; common very fine tubular pores; common fine irregular light gray (10YR 7/2) masses of gypsum throughout; common fine irregular white (10YR 8/1) carbonate threads throughout; slightly effervescent; moderately alkaline; clear wavy boundary.

Cracks 1/2 to 1 inch wide are present from the surface to 20 inches or more for 6 to 8 months. A seasonal high water table of 0 to 18 inches occurs during March through June in most years.

Reaction in the A horizon is medium acid to neutral.

Reaction in the Bss and By horizons is neutral or slightly alkaline.

Reaction in the Bky and C horizons is slightly alkaline or moderately alkaline.

## Forkwood Series

The Forkwood series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Forkwood loam, 0 to 6 percent slopes, about 1,000 feet west and 2,500 feet north of the southeast corner of section 23, T. 46 N., R. 75 W.

- A—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt wavy boundary.

- Bt1—2 to 7 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; many prominent clay films on faces of peds; neutral; abrupt wavy boundary.
- Bt2—7 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong fine prismatic structure parting to strong medium and fine angular blocky; hard, firm, sticky and plastic; common fine and very fine roots; many distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.
- Btk—16 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong medium and fine prismatic structure parting to strong medium and fine angular blocky; hard, firm, sticky and plastic; few fine and very fine roots; many prominent clay films on faces of peds; strongly effervescent; few fine filaments of calcium carbonate; moderately alkaline; clear wavy boundary.
- Bk1—23 to 41 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent; common fine filaments, seams, and masses of calcium carbonate; moderately alkaline; gradual wavy boundary.
- Bk2—41 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent; common fine filaments, seams, and masses of calcium carbonate; strongly alkaline.

Depth to accumulations of calcium carbonate ranges from 12 to 33 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bt horizon texture is loam or clay loam. Reaction is neutral or slightly alkaline.

The Btk and Bk horizon textures are loam or clay loam.

### Gateson Series

The Gateson series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum derived from sandstone and shale. Slopes range from 6 to 30 percent. Elevation is

4,100 to 5,200 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Gateson loamy fine sand, in an area of Gateson-Taluze-Turnercrest complex, 6 to 30 percent slopes, about 950 feet south and 1,400 feet east of the northwest corner of section 22, T. 45 N., R. 69 W.

Oi—0 inches to 2; pine needles and duff.

E—2 to 6 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak very fine granular; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; neutral; clear wavy boundary.

E/B—6 to 11 inches; 50 percent light brownish gray (10YR 6/2) loamy fine sand (E), dark grayish brown (10YR 4/2) moist; 50 percent brown (10YR 5/3) sandy clay loam lamellae 1/4 to 1/2 inch thick(B), dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few coarse, medium, and fine roots; neutral; clear wavy boundary.

Bt—11 to 30 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few coarse, medium, and fine roots; few faint clay films bridging sand grains; slightly alkaline; gradual wavy boundary.

Cr—30 to 60 inches; soft sandstone.

Depth to bedrock ranges from 20 to 40 inches. Rock fragments range from 0 to 10 percent angular sandstone and shale channers.

Reaction in the E horizon is slightly acid or neutral.

The E/B horizon is comprised of 50 to 70 percent E horizon material and 30 to 50 percent B horizon material. Reaction is slightly acid or neutral.

Reaction in the Bt horizon is neutral or slightly alkaline.

### Haverdad Series

The Haverdad series consists of very deep, well drained soils on flood plains and stream terraces. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 4 percent. Elevation is 4,100

to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torrifluvents

Typical pedon of Haverdad loam, 0 to 3 percent slopes, about 50 feet east and 1,100 feet north of the southwest corner of section 34, T. 42 N., R. 76 W.

A—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak platy structure parting to weak fine granular; soft, friable, nonsticky and slightly plastic; few medium and many fine and very fine roots; slightly effervescent; calcium carbonate disseminated; slightly alkaline; clear wavy boundary.

C—4 to 60 inches; pale brown (10YR 6/3) loam, stratified with thin layers of fine sandy loam, very fine sandy loam, sandy clay loam, and silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium and common fine and very fine roots; strongly effervescent; calcium carbonate disseminated; moderately alkaline.

Depth to effervescent layers is 0 to 8 inches.

The A horizon texture is loam or clay loam.

Reaction is slightly alkaline or moderately alkaline.

The C horizon texture is loam or clay loam, stratified with very fine sandy loam, fine sandy loam, silt loam, silty clay loam, and sandy clay loam.

Reaction is slightly alkaline or moderately alkaline.

## Heldt Series

The Heldt series consists of very deep, well drained soils on alluvial fans, fan remnants, and stream terraces. The soils formed in alluvium derived from shale. Slopes range from 0 to 6 percent.

Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustertic Haplocambids

Typical pedon of Heldt clay loam, 0 to 6 percent slopes, about 700 feet south and 1,350 feet west of the northeast corner of section 9, T. 42 N., R. 71 W.

A—0 to 3 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong medium and fine granular structure; hard, firm, sticky and plastic; many medium and fine roots; slightly alkaline; clear smooth boundary.

Bw1—3 to 10 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, very sticky and very plastic; few medium and fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear wavy boundary.

Bw2—10 to 25 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak coarse and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few medium and fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; gradual wavy boundary.

Bk1—25 to 37 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; massive; very hard, firm, very sticky and very plastic; few medium and fine roots; slightly effervescent; many medium and fine masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

Bk2—37 to 60 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; few medium and fine roots; slightly effervescent; few medium and fine masses of calcium carbonate; moderately alkaline.

Cracks 1/2 to 1 inch wide are present from the surface to 25 inches or more for 6 to 8 months.

Reaction in the A horizon is slightly alkaline or moderately alkaline. In the saline phase, reaction is moderately alkaline or strongly alkaline.

The Bw horizon texture is clay or silty clay.

Reaction is moderately alkaline or strongly alkaline.

Electrical conductivity is 2 to 4 millimhos per centimeter; in the saline phase, it ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio is 1 to 5; in the saline phase, it is 1 to 13.

The Bk horizon texture is clay or clay loam.

Reaction is moderately alkaline or strongly alkaline.

Electrical conductivity is 0 to 4 millimhos per centimeter, in the saline phase, it is 8 to 16 millimhos per centimeter. Sodium adsorption ratio is 1 to 5, in the saline phase, it is 1 to 13.

## Hiland Series

The Hiland series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,300 feet. The average annual precipitation is 10 to 14 inches,

the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Calcargids

Typical pedon of Hiland fine sandy loam, in an area of Hiland-Bowbac fine sandy loams, 6 to 15 percent slopes, about 1,000 feet east and 2,000 feet north of the southwest corner of section 31, T. 43 N., R. 73 W.

- A—0 to 2 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.
- Bt1—2 to 5 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.
- Bt2—5 to 14 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.
- Btk—14 to 19 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Bk1—19 to 38 inches; very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Bk2—38 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine irregular light gray (10YR 7/2) carbonate threads

throughout; strongly effervescent; moderately alkaline.

Depth to accumulations of calcium carbonate ranges from 14 to 32 inches.

Reaction in the Bt horizon is neutral or slightly alkaline.

## Hilight Series

The Hilight series consists of shallow, well drained soils on breaks, ridges, and hills. The soils formed in residuum derived from shale. Slopes range from 3 to 45 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Clayey, smectitic, nonacid, mesic, shallow Ustic Torriorthents

Typical pedon of Hilight clay, in an area of Hilight-Wags-Rock outcrop complex, 3 to 45 percent slopes, about 950 feet east and 2,500 feet north of the southwest corner of section 24, T. 42 N., R. 70 W.

- A—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2/5Y 4/2) moist; moderate medium and strong fine granular structure; slightly hard, firm, sticky and plastic; common fine roots; neutral; clear wavy boundary.
- C—2 to 12 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; few fine roots; 30 percent soft shale platelets and 5 percent hard shale channers; neutral; clear wavy boundary.
- Cr—12 to 60 inches; soft grayish brown to dark yellowish brown lignitic shale.

Depth to bedrock ranges from 10 to 20 inches.

The A horizon texture is clay loam or clay. Reaction is slightly acid to slightly alkaline.

The C horizon texture is silty clay or clay. Reaction is neutral or slightly alkaline. Rock fragments range from 0 to 15 percent soft fine shale channers. Authigenic gypsum may be present immediately above the bedrock in some pedons.

## Ironbutte Series

The Ironbutte series consists of very deep, well drained soils on hills and ridges. The soils formed in colluvium and alluvium derived from porcelanite. Slopes range from 3 to 60 percent. Elevation is 4,100

to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Aridic Ustorthents

Typical pedon of Ironbutte channery loam, in an area of Ironbutte-Ironbutte, thin solum, channery loams, 6 to 40 percent slopes, 660 feet north and 250 feet west of the southeast corner of section 19, T. 50 N., R. 71 W.; USGS topographic quadrangle Gillette East, WY; 44 degrees 17 minutes 33 seconds north latitude and 105 degrees 25 minutes 47 seconds west longitude.

A—0 to 4 inches; light reddish brown (5YR 6/3) channery loam, reddish brown (5YR 4/3) moist; moderate very fine granular structure; soft, very friable; 20 percent channers; slightly alkaline (pH 7.4); clear smooth boundary.

C—4 to 12 inches; light reddish brown (5YR 6/4) very channery loam, reddish brown (5YR 4/4) moist; massive; soft, very friable; 55 percent channers 1/2 to 5 inches in length; slightly alkaline (pH 7.4); clear wavy boundary.

2C—12 to 60 inches; fractured porcelanite. Intracacies between coarse fragments are void of fines.

Depth to fragmental material ranges from 7 to 20 inches.

Reaction in the A horizon is neutral or slightly alkaline. Rock fragments range from 5 to 40 percent, with 0 to 5 percent flagstone porcelanite fragments.

The C horizon texture is very channery loam or extremely channery loam. Reaction is neutral to moderately alkaline. Rock fragments range from 35 to 90 percent, with 0 to 15 percent flagstones and 0 to 5 percent stones.

## Iwait Series

The Iwait series consists of very deep, well drained soils on alluvial fans, fan remnants, stream terraces, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 20 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents

Typical pedon of Iwait loam, in an area of Ziggy-Iwait loams, 0 to 6 percent slopes, about 1,340 feet

north and 1,750 feet west of the southeast corner of section 5, T. 55 N., R. 72 W.; USGS topographic quadrangle Whitetail Butte, WY; 44 degrees 46 minutes 30 seconds N. latitude and 105 degrees 32 minutes 24 seconds W. longitude.

A—0 to 6 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots throughout; strongly effervescent; carbonates are disseminated throughout; slightly alkaline; clear smooth boundary.

Bk1—6 to 20 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout and common fine rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—20 to 60 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout and common fine rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; moderately alkaline.

Depth to calcium carbonate accumulations is 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The Bk horizon texture is loam or clay loam. Electrical conductivity is 0 to 2 millimhos per cm.; in mapping unit 203, it is 2 to 4 millimhos per cm.

## Jayem Series

The Jayem series consists of very deep, well drained soils on the leeward side of hills. The soils formed in eolian deposits derived from sandstone. Slopes range from 6 to 20 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Aridic Haplustolls

Typical pedon of Jayem fine sandy loam, 6 to 20 percent slopes, about 500 feet east and 500 feet north of the southwest corner of section 12, T. 45 N., R. 75 W.

A1—0 to 7 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and fine granular structure; soft, very friable, nonsticky and nonplastic; few medium and many fine and very fine roots; neutral; clear smooth boundary.

A2—7 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few medium and common fine and very fine roots; neutral; clear wavy boundary.

Bw—17 to 31 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, nonsticky and nonplastic; few medium and common fine and very fine roots; neutral; gradual wavy boundary.

C—31 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; few medium, fine, and very fine roots; neutral.

The mollic epipedon is 10 to 17 inches thick.

The Bw and C horizon textures are fine sandy loam or sandy loam. Reaction is neutral or slightly alkaline in the C horizon.

### Jaywest Series

The Jaywest series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from shale. Slopes range from 0 to 6 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Paleustalfs

Typical pedon of Jaywest loam, 0 to 6 percent slopes, about 500 feet north and 450 feet west of the southeast corner of section 4, T. 49 N., R. 73 W.; USGS topographic quadrangle Four Bar J Ranch, WY; 44 degrees 14 minutes 48 seconds north latitude and 105 degrees 37 minutes 59 seconds west longitude.

E—0 to 7 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate thick platy structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; neutral (pH 6.8); abrupt wavy boundary.

Bt1—7 to 12 inches; brown (10YR 5/3) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; many fine and very fine and few medium roots; neutral; abrupt smooth boundary.

Bt2—12 to 27 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; strong coarse prismatic structure parting to strong coarse and medium angular blocky; extremely hard, very firm, very sticky and very plastic; common fine and very fine and few medium roots; many faint dark brown (10YR 3/3) clay films on faces of peds and lining pores; neutral; clear wavy boundary.

Btk—27 to 36 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate medium and fine prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; few medium, fine and very fine roots; few faint dark brown (10YR 3/3) clay films on faces of peds; common fine irregular light gray (10YR 7/2) carbonate threads; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—36 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak coarse and medium subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; common fine irregular light gray (10YR 7/2) carbonate threads and common fine rounded light gray (10YR 7/2) masses of carbonate; strongly effervescent; moderately alkaline.

Depth to calcium carbonate accumulations ranges from 13 to 27 inches.

Reaction in the E horizon is slightly acid or neutral.

The Bt and Btk horizon textures are clay loam or clay. Reaction is neutral or slightly alkaline.

The Bk horizon texture is clay loam or loam.

### Julesburg Series

The Julesburg series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium and eolian deposits derived from sandstone. Slopes range from 0 to 6 percent.

Elevation is 4,200 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical pedon of Julesburg fine sandy loam, 0 to 6 percent slopes, about 1,300 feet east and 2,100 feet south of the northwest corner of section 16, T. 42 N., R. 70 W.

A—0 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear wavy boundary.

Bt1—10 to 20 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; soft, friable, nonsticky and slightly plastic; common fine and very fine roots; many prominent clay films bridging sand grains, many faint clay films on faces of peds; neutral; clear wavy boundary.

Bt2—20 to 32 inches; light yellowish brown (10YR 6/4) fine sandy loam, brown (10YR 5/3) moist; weak coarse and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; many distinct clay films bridging sand grains, common faint clay films on faces of peds; slightly alkaline; gradual wavy boundary.

C—32 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, friable, nonsticky and nonplastic; few fine and very fine roots; slightly alkaline.

The mollic epipedon is 10 to 16 inches thick. The soils are typically noneffervescent throughout, but may be slightly effervescent below 50 inches in some pedons.

The Bt and C horizon textures are fine sandy loam or sandy loam. Reaction is neutral or slightly alkaline.

### Keeline Series

The Keeline series consists of very deep, well drained soils on ridges, hills, and stream terraces. The soils formed in alluvium or eolian deposits derived from sandstone. Slopes range from 0 to 20 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents

Typical pedon of Keeline fine sandy loam, in an area of Turnercrest-Keeline-Taluze fine sandy loams, 6 to 30 percent slopes, about 700 feet north and 2,000 feet east of the southwest corner of section 2, T. 43 N., R. 75 W.

A—0 to 4 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; weak fine angular blocky structure parting to weak fine and very fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; strongly effervescent, calcium carbonate disseminated; moderately alkaline; gradual wavy boundary.

C1—4 to 10 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; violently effervescent; calcium carbonate disseminated; moderately alkaline; gradual wavy boundary.

C2—10 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; violently effervescent; calcium carbonate disseminated; strongly alkaline.

Depth to effervescent layers ranges from 0 to 6 inches.

The A horizon texture is loamy sand or sandy loam. Reaction is slightly alkaline or moderately alkaline.

The C horizon texture is sandy loam or fine sandy loam.

### Keyner Series

The Keyner series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Haplic Ustic Natrargids

Typical pedon of Keyner fine sandy loam, 0 to 6 percent slopes, about 200 feet east and 400 feet south of the northwest corner of section 35, T. 42 N., R. 71 W.

E—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine granular

structure; soft, friable, nonsticky and nonplastic; common medium and many fine and very fine roots; slightly alkaline; clear wavy boundary.

Bt—4 to 12 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate coarse columnar structure parting to moderate coarse angular blocky; hard, firm, slightly sticky and slightly plastic; few fine and very fine roots; common faint clay films on faces of peds; moderately alkaline; clear wavy boundary.

Btn—12 to 20 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and very fine roots; common faint clay films on faces of peds; common medium and fine filaments and masses of calcium sulfate; strongly alkaline; gradual wavy boundary.

Btkn—20 to 26 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and very fine roots; common faint clay films on faces of peds; slightly effervescent; common medium and fine seams, filaments, and masses of calcium carbonate; few fine masses and medium crystals of calcium sulfate; very strongly alkaline; gradual wavy boundary.

Bkn1—26 to 48 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; slightly effervescent; common medium and fine seams and masses of calcium carbonate; few fine masses and medium crystals of calcium sulfate; very strongly alkaline; gradual wavy boundary.

Bkn2—48 to 60 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; slightly effervescent; few medium and fine seams and masses of calcium carbonate and calcium sulfate; strongly alkaline.

Depth to calcium carbonate accumulations ranges from 12 to 18 inches. Depth to the natric horizon ranges from 14 to 20 inches.

Reaction in the E horizon is slightly alkaline or moderately alkaline. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio ranges from 0 to 5.

The Bt, Btn, and Btkn horizon textures are sandy clay loam or clay loam. Electrical conductivity ranges

from 0 to 2 millimhos per centimeter and sodium adsorption ratio ranges from 2 to 9 in the Bt horizon.

Reaction is strongly alkaline or very strongly alkaline and electrical conductivity ranges from 8 to 16 millimhos per centimeter in the Btn and Btkn horizons. Sodium adsorption ratio ranges from 10 to 20 in the Btn horizon and from 15 to 30 in the Btkn horizon.

The Bkn horizon texture is sandy loam, fine sandy loam, or sandy clay loam. Reaction is strongly alkaline or very strongly alkaline. Electrical conductivity ranges from 8 to 16 millimhos per centimeter. Sodium adsorption ratio ranges from 15 to 30.

## Kishona Series

The Kishona series consists of very deep, well drained soils on alluvial fans, fan remnants, stream terraces, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents

Typical pedon of Kishona loam, in an area of Theedle-Kishona loams, 6 to 20 percent slopes, about 1,500 feet west and 2,300 feet south of the northeast corner of section 27, T. 42 N., R. 76 W.

A—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium and moderate fine granular structure; slightly hard, friable, sticky and slightly plastic; many fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear wavy boundary.

Bk1—4 to 15 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine and very fine roots; strongly effervescent; common medium and many fine rounded masses of calcium carbonate; strongly alkaline; clear wavy boundary.

Bk2—15 to 60 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; few fine

and very fine roots; strongly effervescent; few medium and common fine rounded masses of calcium carbonate; strongly alkaline.

Depth to accumulations of calcium carbonate ranges from 0 to 5 inches.

The A and Bk horizon textures are loam or clay loam. Reaction is slightly alkaline or moderately alkaline in the A horizon.

## Lawver Series

The Lawver series consists of very deep, well drained soils on mesas and terraces. These soils formed in alluvium or eolian deposits over weathered porcelanite. Slopes range from 0 to 15 percent. Elevation is 4,200 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Paleargids

Typical pedon of Lawver loam, in an area of Lawver-Teckla-Wibaux complex, 0 to 6 percent slopes, about 50 feet south and 1,900 feet east of the northwest corner of section 14, T. 43 N., R. 69 W.; 43 degrees 42 minutes 33 seconds north latitude and 105 degrees 6 minutes and 51 seconds west longitude.

E—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak thick platy structure parting to weak fine and medium granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; 5 percent angular porcelanite channers; neutral; abrupt smooth boundary.

Bt1—4 to 10 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; 5 percent angular porcelanite channers; neutral; clear smooth boundary.

Bt2—10 to 20 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; strong fine and medium prismatic structure parting to strong fine and medium angular blocky; hard, firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous

dark brown (10YR 3/3) clay films on faces of peds; 8 percent angular porcelanite channers; neutral; clear wavy boundary.

Btk—20 to 27 inches; pinkish gray (7.5YR 6/2) channery clay loam, brown (7.5YR 5/4) moist; strong fine and medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; strongly effervescent; carbonates are disseminated throughout; 20 percent angular porcelanite channers; slightly alkaline; gradual wavy boundary.

Bk—27 to 38 inches; light brown (7.5YR 6/4) very channery clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, moderately sticky and moderately plastic; common very fine and fine roots throughout; strongly effervescent; carbonates are disseminated throughout; 40 percent angular porcelanite channers and 10 percent subrounded mixed cobbles; strongly alkaline; clear wavy boundary.

2C—38 to 60 inches; fractured porcelanite with 8 percent partly filled interstices of light reddish brown (2.5YR 6/4) sandy loam, reddish brown (2.5YR 4/4) moist; massive; soft, friable, nonsticky and nonplastic; common fine roots throughout; soil matrix is noneffervescent but thin coatings of carbonate occur on some rock fragments; 65 percent angular porcelanite channers, 20 percent subangular mixed flagstones, and 7 percent subrounded mixed stones; neutral.

Depth to accumulations of calcium carbonate ranges from 10 to 22 inches. Depth to strongly contrasting particle size ranges from 20 to 40 inches.

Reaction in the E horizon is neutral or slightly alkaline.

The Bt horizon texture is clay loam or clay. Rock fragments range from 0 to 15 percent porcelanite channers. Reaction is neutral or slightly alkaline.

The Btk horizon texture is channery clay loam or channery clay. Reaction is slightly alkaline or moderately alkaline. Rock fragments range from 15 to 30 percent porcelanite channers.

The Bk horizon texture is very channery clay loam or very channery loam. Rock fragments range from 35 to 60 percent porcelanite channers and 0 to 10 percent cobbles.

Reaction in the 2C horizon is slightly acid to slightly alkaline. Rock fragments range from 35 to 90

percent porcelanite fragments, of which 35 to 70 percent are channers, 10 to 20 percent flagstones, and 0 to 10 percent stones.

### Leiter Series

The Leiter series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum or alluvium over residuum derived primarily from shale. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Haplustalfs

Typical pedon of Leiter clay loam, in an area of Moorhead-Leiter clay loams, 0 to 6 percent slopes; about 1,650 feet west and 1,900 feet north of the southeast corner of section 20, T. 50 N., R. 73 W.; USGS topographic quadrangle Oriva, WY; 44 degrees 18 minutes 21 seconds north latitude and 105 degrees 40 minutes 21 seconds west longitude.

A—0 to 3 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium and strong fine granular structure; slightly hard, friable, sticky and plastic; many very fine and fine and few medium roots; neutral (pH 7.0); clear smooth boundary.

Bt1—3 to 8 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to strong medium and fine angular blocky; hard, firm, moderately sticky and moderately plastic; many very fine, common fine, and few medium roots throughout; few faint brown (10YR 4/3) clay films on faces of peds; neutral (pH 7.0); clear smooth boundary.

Bt2—8 to 17 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; common fine and very fine and few medium roots throughout; few faint dark brown (10YR 3/3) clay films on faces of peds; slightly alkaline (pH 7.4); clear wavy boundary.

Btk—17 to 22 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; common fine and very fine and few medium roots throughout; few distinct dark brown (10YR 3/3) clay films on faces

of peds; common fine irregular light gray (10YR 7/2) carbonate threads and fine rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; moderately alkaline (pH 8.2); clear wavy boundary.

Bk—22 to 33 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common very fine and fine roots throughout; common fine and medium irregular light gray (10YR 7/2) carbonate threads and fine rounded light gray (10YR 7/2) masses of carbonate throughout; strongly effervescent; moderately alkaline (pH 8.4); clear wavy boundary.

Cr—33 to 60 inches; brownish yellow to grayish brown soft shale; slightly effervescent to about 50 inches and inconsistently effervescent below.

Depth to accumulations of calcium carbonate ranges from 9 to 21 inches. Depth to bedrock ranges from 20 to 40 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bt, Btk, and Bk horizon textures are clay loam or clay. Reaction in the Bt horizon is neutral or slightly alkaline.

### Lismas Series

The Lismas series consists of shallow, well drained soils on ridges and hills. The soils formed in residuum derived from nonacid shale. Slopes range from 3 to 45 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 48 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Clayey, smectitic, nonacid, mesic, shallow Aridic Ustorthents

Typical pedon of Lismas clay loam, about 1,950 feet west and 1,500 feet south of the northeast corner of section 24, T. 56 N., R. 69 W.; USGS topographic quadrangle Bonnie Reservoir, WY; 44 degrees 49 minutes 33 seconds north latitude and 105 degrees 4 minutes 59 seconds west longitude.

A—0 to 3 inches; olive brown (2.5Y 4/3) clay loam, dark olive brown (2.5Y 3/3) moist; moderate fine and medium angular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and moderately plastic; many very fine and fine and common medium roots throughout;

many very fine and fine pores; neutral; clear wavy boundary.

C—3 to 12 inches; olive brown (2.5Y 4/3) clay, dark olive brown (2.5Y 3/3) moist; strong medium and coarse angular blocky structure; hard, friable, very sticky and very plastic; many very fine and fine roots throughout; many very fine and fine pores; very slightly effervescent; inconsistently effervescent; neutral; clear wavy boundary.

Cy—12 to 16 inches; dark olive brown (2.5Y 3/3) and olive brown (2.5Y 4/3) clay; moderate fine and medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine and fine roots throughout; common very fine and fine pores; few distinct discontinuous strong brown (7.5YR 5/6) iron stains on faces of peds; common fine irregular light gray (10YR 7/2) masses of gypsum throughout; 15 percent angular shale fragments that break down with pretreatment; slightly alkaline; clear wavy boundary.

Cr—16 to 60 inches; shale bedrock.

Depth to bedrock ranges from 6 to 20 inches.

Reaction in the A horizon is slightly acid to slightly alkaline. 0 to 15 percent fragments of selenite are scattered on the surface.

The C horizon texture is clay or silty clay. Reaction is moderately acid to slightly alkaline. Rock fragments range from 0 to 15 percent shale channers.

## Maysdorf Series

The Maysdorf series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,100 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Calcargids

Typical pedon of Maysdorf fine sandy loam, 0 to 6 percent slopes, about 1,300 feet north and 2,450 feet west of the southeast corner of section 14, T. 46 N., R. 71 W.; 43 degrees 57 minutes 37 seconds north latitude and 105 degrees 21 minutes 7 seconds west longitude.

A—0 to 3 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and

nonplastic; many very fine and fine roots throughout; neutral; clear smooth boundary.

BA—3 to 7 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots throughout; few faint clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

Bt1—7 to 19 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; strong medium prismatic structure; hard, firm, sticky and plastic; many fine and very fine roots throughout; many distinct discontinuous clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

Bt2—19 to 33 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky and plastic; few fine and very fine roots throughout; common clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bk—33 to 60 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots throughout; common fine seams and round masses of calcium carbonate; violently effervescent; moderately alkaline.

Depth to accumulations of calcium carbonate ranges from 17 to 33 inches.

The A horizon texture is sandy loam, fine sandy loam, or sandy clay loam.

Reaction in the Bt horizon is neutral or slightly alkaline.

The Bk horizon texture is sandy loam or fine sandy loam. Reaction is slightly alkaline or moderately alkaline.

## Mittenbutte Series

The Mittenbutte series consists of shallow, well drained soils on hills and ridges. The soils formed in residuum derived from interbedded sandstone and shale. Slopes range from 6 to 40 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthents

Typical pedon of Mittenbutte fine sandy loam, about 1,200 feet east and 350 feet north of the southwest corner of section 22, T. 57 N., R. 73 W.; USGS topographic quadrangle Corral Creek, WY; 44 degrees 54 minutes 13 seconds north latitude and 105 degrees 37 minutes 44 seconds west longitude.

A—0 to 3 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; strongly effervescent; 1 percent angular sandstone gravel; slightly alkaline; gradual smooth boundary.

AC—3 to 9 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak fine granular; loose, very friable, nonsticky and nonplastic; strongly effervescent; about 1 percent angular sandstone gravel; moderately alkaline; clear smooth boundary.

C—9 to 16 inches; light yellowish brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; massive; loose, very friable, nonsticky and nonplastic; strongly effervescent; 1 percent angular sandstone gravel; moderately alkaline; clear wavy boundary.

Cr—16 to 60 inches; light yellowish brown (2.5Y 6/3) soft calcareous sandstone, light olive brown (2.5Y 5/3) moist.

Depth to bedrock ranges from 10 to 20 inches. Depth to calcium carbonate ranges from 0 to 6 inches.

Reaction in the A horizon is slightly alkaline or moderately alkaline.

The C horizon texture is fine sandy loam or sandy loam. Reaction is moderately alkaline or strongly alkaline.

**Note:** The Mittenbutte soil in map unit 162 is a taxadjunct to the Mittenbutte series. The soil in this map unit is slightly acid or neutral throughout and is noneffervescent. This soil is classified as loamy, mixed, superactive, nonacid, mesic, shallow Aridic Ustorthents.

### Moorhead Series

The Moorhead series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived primarily from shale. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual

air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Haplustalfs

Typical pedon of Moorhead clay loam, 0 to 6 percent slopes, about 2,450 feet east and 1,450 feet north of the southwest corner of section 36, T. 55 N., R. 69 W.; USGS topographic quadrangle Brislawn School, WY; 44 degrees 42 minutes 13 seconds north latitude and 105 degrees 5 minutes 44 seconds west longitude.

A—0 to 4 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, moderately sticky and moderately plastic; many very fine and fine roots throughout; many fine vesicular pores throughout; neutral (pH 7.4); clear smooth boundary.

Bt—4 to 18 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; strong medium and coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, very sticky and very plastic; common fine and few medium roots throughout; many fine irregular pores throughout; many distinct continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly alkaline (pH 7.6); clear wavy boundary.

Btk—18 to 24 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium and coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, very sticky and very plastic; common very fine and fine roots throughout; many fine irregular pores throughout; common distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

Bk1—24 to 32 inches; light olive brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) moist; strong medium and coarse prismatic structure parting to moderate fine and medium angular blocky; hard, firm, very sticky and very plastic; common very fine and fine roots throughout; common fine irregular pores throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

Bk2—32 to 60 inches; light yellowish brown (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) moist;

moderate fine and medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; common fine irregular pores throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; strongly alkaline (pH 8.4).

Depth to accumulations of calcium carbonate ranges from 13 to 29 inches.

The A horizon texture is clay loam or loam.

The Bt, Btk, and Bk horizon textures are clay or clay loam. Reaction is neutral or slightly alkaline in the Bt horizon.

### Moskee Series

The Moskee series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 10 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical pedon of Moskee fine sandy loam, 0 to 6 percent slopes, about 2,400 feet north and 1,100 feet east of the southwest corner of section 12, T. 54 N., R. 74 W.; USGS topographic quadrangle Recluse, WY; 44 degrees 40 minutes 34 seconds north latitude and 105 degrees 42 minutes 42 seconds west longitude.

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; common fine pores; neutral; clear smooth boundary.

A2—6 to 9 inches; brown (10YR 5/3) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; many fine pores; neutral; clear wavy boundary.

Bt—9 to 24 inches; dark yellowish brown (10YR 4/4) sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots

throughout; many fine pores; common distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; gradual wavy boundary.

Btk—24 to 32 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; common fine pores; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; common fine irregular light gray (10YR 7/2) carbonate threads throughout; slightly effervescent; slightly alkaline; clear wavy boundary.

Bk—32 to 60 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; loose, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; many fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 20 inches thick and commonly includes part of the argillic horizon. Depth to calcium carbonate accumulations ranges from 10 to 35 inches.

The Bt horizon texture is sandy clay loam, very fine sandy loam, or fine sandy loam. Reaction is neutral or slightly alkaline.

The Bk horizon texture is fine sandy loam or sandy loam.

### Muleherder Series

The Muleherder series consists of very deep, well drained soils on hills and ridges. The soils formed in colluvium and alluvium derived from porcelanite. Slopes range from 3 to 60 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy-skeletal over fragmental, mixed, superactive, mesic Aridic Haplustepts

Typical pedon of Muleherder channery loam, in an area of Muleherder-Ironbutte channery loams, 3 to 40 percent slopes, about 200 feet west and 900 feet south of the northeast corner of section 7, T. 57 N., R. 73 W.; USGS topographic quadrangle Corral Creek, WY; 44 degrees 56 minutes 36 seconds north

latitude and 105 degrees 40 minutes 31 seconds west longitude.

A—0 to 2 inches; reddish brown (5YR 4/3) channery loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; 5 percent angular porcelanite channers; neutral; clear smooth boundary.

Bw1—2 to 12 inches; reddish brown (5YR 4/4) channery loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 15 percent angular porcelanite channers; neutral; clear smooth boundary.

Bw2—12 to 16 inches; red (2.5YR 5/6) channery loam, red (2.5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 20 percent angular porcelanite channers; neutral; clear wavy boundary.

BCK1—16 to 28 inches; light reddish brown (5YR 6/4) very channery fine sandy loam, reddish brown (5YR 5/4) moist; massive; loose, nonsticky and nonplastic; few distinct discontinuous light gray (10YR 7/2) carbonate coats on rock fragments; strongly effervescent; 40 percent angular porcelanite channers; moderately alkaline; clear wavy boundary.

BCK2—28 to 33 inches; red (2.5YR 5/6) extremely channery fine sandy loam, red (2.5YR 4/6) moist; massive; loose, nonsticky and nonplastic; few distinct discontinuous light gray (10YR 7/2) carbonate coats on rock fragments; strongly effervescent; 65 percent angular porcelanite channers; moderately alkaline; clear wavy boundary.

2C—33 to 60 inches; fractured porcelanite.

Depth to the fragmental substrata ranges from 20 to 40 inches. Depth to calcium carbonate accumulations ranges from 0 to 24 inches. The fragmental materials in some pedons are inconsistently calcareous.

Rock fragments range from 0 to 40 percent in the A horizon, with 0 to 5 percent flagstones and stones.

The Bw horizon texture is channery loam or very channery loam. Reaction is neutral to moderately alkaline. Rock fragments range from 15 to 90 percent, with 0 to 5 percent stones and 0 to 15 percent flagstones.

The BCK horizon texture is very channery or extremely channery fine sandy loam. Reaction is

neutral to moderately alkaline. Rock fragments range from 15 to 90 percent, with 0 to 5 percent stones and 0 to 15 percent flagstones.

The 2C horizon consists of fractured porcelanite material. A soil matrix is uncommon, but when present is less than 5 percent. Flagstones make up from 15 to 45 percent and channers 50 to 85 percent of this horizon.

## Niobrara Series

The Niobrara series consists of shallow, excessively drained soils on ridges and hills. The soils formed in residuum and wind reworked material derived from sandstone. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Mixed, mesic, shallow Aridic Ustipsamments

Typical pedon of Niobrara loamy sand, in an area of Keeline-Tulloch-Niobrara, dry complex, 3 to 30 percent slopes, about 2,200 feet east and 2,220 feet south of the northwest corner of section 7, T. 42 N., R. 75 W.

A—0 to 3 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; single grain; loose, friable, nonsticky and nonplastic; many fine and very fine roots; slightly effervescent; calcium carbonate disseminated; slightly alkaline; clear wavy boundary.

C—3 to 12 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; massive structure parting to single grain; loose, friable, nonsticky and nonplastic; common fine and very fine roots; neutral; clear wavy boundary.

Cr—12 to 60 inches; slightly hard, coarse sandstone.

Depth to bedrock ranges from 10 to 20 inches. The soils can be noneffervescent throughout, but commonly are slightly effervescent in the surface layer where deposition of fine earth material containing calcium carbonate has occurred. Rock fragments range from 0 to 10 percent hard angular gravel.

Reaction in the A horizon is slightly acid to slightly alkaline.

The C horizon texture is sand and loamy sand. Reaction is neutral or slightly alkaline.

## Nuncho Series

The Nuncho series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,300 to 5,200 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Argiustolls

Typical pedon of Nuncho loam, 0 to 6 percent slopes, about 750 feet west and 1,300 feet north of the southeast corner of section 12, T. 49 N., R. 73 W.; USGS topographic quadrangle Apple Butte, WY; 44 degrees 14 minutes 5 seconds north latitude and 105 degrees 34 minutes 22 seconds west longitude.

A1—0 to 7 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak medium granular structure parting to moderate fine subangular blocky; soft, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

A2—7 to 12 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bt1—12 to 18 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong fine and medium angular blocky; hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.

Bt2—18 to 30 inches; pale brown (10YR 6/3) clay, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.

Bk—30 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine and medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

The mollic epipedon is 8 to 15 inches thick. Depth to calcium carbonate accumulations ranges from 14 to 34 inches.

The Bt horizon texture is clay loam or clay. Reaction is neutral or slightly alkaline.

## Oldwolf Series

The Oldwolf series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium over residuum derived from mixed sedimentary sources. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Oldwolf loam, in an area of Deekay-Oldwolf loams, 0 to 6 percent slopes, about 100 feet east and 2,300 feet south of the northwest corner of section 16, T. 48 N., R. 71 W.; 44 degrees 8 minutes 20 seconds north latitude and 105 degrees 24 minutes 11 seconds west longitude.

A—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium and moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; neutral (pH 6.8); clear smooth boundary.

Bt—5 to 14 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium and fine angular blocky; hard, friable, sticky and plastic; common fine and very fine and few medium roots; many distinct clay films on faces of peds; slightly alkaline (pH 7.4); clear smooth boundary.

Btk—14 to 21 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium and fine prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable, slightly sticky and plastic; few fine and very fine roots; common faint clay films on faces of peds and lining pores; strongly effervescent; calcium carbonate mostly disseminated; slightly alkaline (pH 7.8); clear wavy boundary.

Bk—21 to 35 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; slightly hard, friable,

slightly sticky and slightly plastic; few fine and very fine roots; strongly effervescent; common fine filaments and masses and few medium masses of calcium carbonate; moderately alkaline (pH 8.2); clear wavy boundary.

Cr—35 to 60 inches; yellowish brown (10YR 5/4) to light gray (10YR 7/2) silty shale.

Depth to calcium carbonate accumulations ranges from 14 to 32 inches. Depth to bedrock ranges from 20 to 40 inches.

The Bt, Btk, and Bk horizon textures are clay loam or loam. Reaction is neutral or slightly alkaline in the Bt horizon and slightly alkaline or moderately alkaline in the Btk horizon.

### Orpha Series

The Orpha series consists of very deep, excessively drained soils on upland dunes. The soils formed in eolian deposits derived from sandstone. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Mixed, mesic Ustic Torripsamments

Typical pedon of Orpha fine sand, in an area of Embry-Orpha complex, 3 to 15 percent slopes, about 200 feet west and 300 feet north of the southeast corner of section 34, T. 43 N., R. 72 W.

A—0 to 4 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few medium and common fine roots; neutral; gradual smooth boundary.

C—4 to 60 inches; brownish yellow (10YR 6/6) fine sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; neutral.

The soils are typically noneffervescent throughout, but some pedons may be slightly effervescent between 40 and 60 inches.

The A and C horizon textures are fine sand or loamy sand. Reaction is neutral or slightly alkaline.

### Oshoto Series

The Oshoto series consists of very deep, well drained soils on alluvial fans and fan remnants. The

soils formed in alluvium derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-silty, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Oshoto silt loam, about 1,300 feet west and 600 feet south of the northeast corner section 34, T. 56 N., R. 75 W.; USGS topographic quadrangle Reservoir Creek, WY; 44 degrees 47 minutes 37 seconds north latitude and 105 degrees 52 minutes 5 seconds west longitude.

A—0 to 7 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; loose, friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

Bt1—7 to 14 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; neutral; clear wavy boundary.

Bt2—14 to 22 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline; gradual wavy boundary.

Btk—22 to 32 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few distinct discontinuous olive brown (2.5Y 4/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; gradual wavy boundary

Bk1—32 to 43 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk2—43 to 60 inches; light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) moist; moderate medium and coarse angular blocky structure; loose, very friable, nonsticky and nonplastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; strongly alkaline.

Depth to continuous accumulations of calcium carbonate ranges from 10 to 27 inches.

Some pedons have an E horizon with characteristics similar to those of the A horizon.

The Bt and Btk horizon textures are silty clay loam or clay loam. Reaction is neutral or slightly alkaline in the Bt horizon.

The Bk horizon texture is silty clay loam, silt loam, or loam. Reaction is slightly alkaline or moderately alkaline.

### Parmleed Series

The Parmleed series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum or alluvium over residuum derived from shale, or interbedded shale and sandstone. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Paleargids

Typical pedon of Parmleed loam, in an area of Parmleed-Renohill complex, 3 to 15 percent slopes, about 500 feet north and 1,600 feet west of the southeast corner of section 4, T. 45 N., R. 69 W. (fig. 4).

E—0 to 3 inches; pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; weak fine and moderate very fine granular structure; soft, friable, nonsticky and nonplastic; few medium and many fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—3 to 6 inches; pale brown (10YR 6/3) clay loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate medium and fine platy; slightly hard, friable, slightly sticky and slightly plastic; few medium and many fine and very fine roots; neutral; abrupt smooth boundary.

Bt2—6 to 15 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to strong

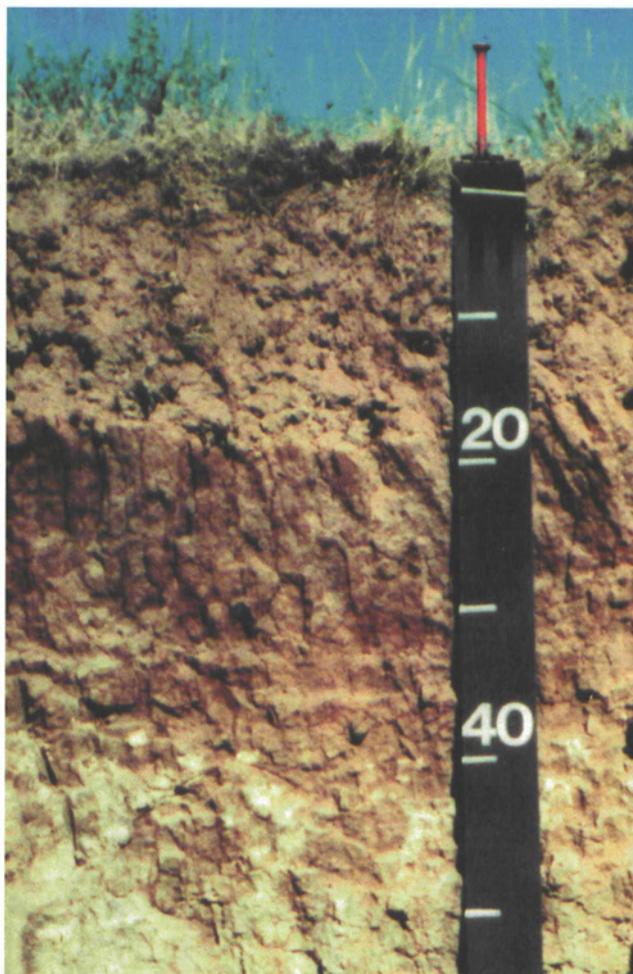


Figure 4. Typical pedon of the Parmleed series. This is a moderately deep, fine textured soil with shale occurring at a depth of about 27 inches.

medium angular blocky; extremely hard, very firm, very sticky and very plastic; few medium and common fine and very fine roots; many prominent clay films on faces of peds; slightly alkaline; clear wavy boundary.

Btk—15 to 21 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; strong medium prismatic structure parting to strong medium angular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; many distinct and common prominent clay films on faces of peds; strongly effervescent; many medium and fine masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Bk—21 to 27 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; weak medium subangular blocky structure; hard, firm, very sticky and plastic; few fine roots; strongly

effervescent; many fine seams and masses of calcium carbonate; strongly alkaline; gradual wavy boundary.

Cr—27 to 60 inches; soft effervescent sandy and silty shale.

Depth to bedrock ranges from 20 to 40 inches. Depth to accumulations of calcium carbonate ranges from 10 to 20 inches.

The Bt, Btk, and Bk horizon textures are clay or clay loam. Reaction is neutral or slightly alkaline in the Bt horizon.

### Pitchdraw Series

The Pitchdraw series consists of moderately deep, well drained soils formed in alluvium or eolian deposits over residuum derived from soft sandstone. They are on hills and ridges. Slopes range from 2 to 30 percent. Elevation is 4,300 to 5,200 feet. The average annual precipitation is about 15 inches, the mean annual temperature is 45 to 50 degrees F., and the frost free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents  
 Typical pedon of Pitchdraw fine sandy loam, about 600 feet west and 2,500 feet north of the southeast corner of section 28, T. 55 N. R. 73 W.; USGS topographic quadrangle Recluse, WY; 44 degrees, 52 minutes, 54 seconds north latitude and 105 degrees, 38 minutes, 28 seconds west longitude.

A—0 to 4 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; many fine and very fine roots; few fine pores; carbonates are disseminated throughout; slightly effervescent; slightly alkaline (pH 7.6); clear smooth boundary.

Bk1—4 to 9 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable; common fine and very fine roots; few fine pores; strongly effervescent; carbonates disseminated throughout; moderately alkaline (pH 8.0); gradual wavy boundary.

Bk2—9 to 31 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; few fine roots throughout; few fine pores; strong effervescence; few fine irregular light gray (10YR 7/2) carbonate threads throughout; carbonates disseminated throughout; moderately alkaline (pH 8.2); clear wavy boundary.

Cr—31 to 60 inches; soft, light gray and very pale brown, calcareous sandstone.

Depth to paralithic contact or bedrock ranges from 20 to 40 inches. Depth to calcium carbonate accumulations ranges from 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The Bk horizon texture is fine sandy loam or sandy loam.

### Platmak Series

The Platmak series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium derived from shale. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,100 feet. The average annual precipitation is 14 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Paleustolls

Typical pedon of Platmak loam, 0 to 6 percent slopes, about 1,050 feet west and 925 feet north of the southeast corner of section 34, T. 51 N., R. 73 W.; USGS topographic quadrangle Gillette West, WY; 44 degrees 21 minutes 1 second north latitude and 105 degrees 36 minutes 52 seconds west longitude.

E—0 to 4 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; strong thin platy structure parting to strong very fine granular; soft, very friable, slightly sticky and nonplastic; many very fine and fine and common medium roots throughout; neutral; abrupt smooth boundary.

Bt1—4 to 12 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong fine and medium angular blocky; hard, firm, very sticky and very plastic; many very fine and fine and common medium roots throughout; few distinct discontinuous black (10YR 2/1) clay films on faces of peds and in pores; neutral; clear smooth boundary.

Bt2—12 to 18 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky; hard, firm, very sticky and very plastic; many very fine and fine and common medium roots throughout; few distinct

discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; slightly alkaline; clear wavy boundary.

Btk—18 to 27 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, very sticky and moderately plastic; common very fine to medium roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—27 to 40 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—40 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; hard, friable, moderately sticky and moderately plastic; common fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

The mollic epipedon ranges from 7 to 19 inches thick. Depth to continuous accumulations of calcium carbonate ranges from 13 to 30 inches.

The Bt and Btk horizon textures are clay or clay loam. Reaction is neutral to slightly alkaline in the Bt horizon.

### Pugsley Series

The Pugsley series consists of moderately deep, well drained soils on hills and ridges. The soils formed in eolian deposits and residuum derived from sandstone. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Pugsley sandy loam, in an area of Maysdorf-Pugsley sandy loams, 0 to 6 percent

slopes, about 70 feet east and 720 feet south of the northwest corner of section 8, T. 42 N., R. 70 W.

A—0 to 4 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many fine and few very fine roots; neutral; clear smooth boundary.

Bt—4 to 15 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 3/4) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and plastic; common fine and few very fine roots; common faint clay films on faces of peds; neutral; clear smooth boundary.

C—15 to 23 inches; yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few very fine roots; slightly alkaline; clear wavy boundary.

Cr—23 to 60 inches; soft sandstone.

Depth to bedrock is 20 to 40 inches. The soils are typically noneffervescent throughout but may be inconsistently effervescent 1 to 3 inches above the bedrock in some pedons.

Reaction in the Bt horizon is neutral or slightly alkaline.

The C horizon texture is sandy loam or fine sandy loam.

### Rauzi Series

The Rauzi series consists of very deep, well drained soils on fan remnants and hills. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 10 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Rauzi fine sandy loam, 0 to 6 percent slopes, 500 feet south and 2,000 feet east of the northwest corner of section 30, T. 50 N., R. 71 W.; USGS topographic quadrangle Gillette East, WY; 44 degrees 17 minutes 21 seconds north latitude and 105 degrees 26 minutes 28 seconds west longitude.

A—0 to 3 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and

medium granular structure; soft, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

Bt1—3 to 10 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; neutral; clear smooth boundary.

Bt2—10 to 22 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium prismatic structure parting to weak medium angular blocky; hard, firm, moderately sticky and moderately plastic; few distinct discontinuous dark reddish brown (5YR 3/4) clay films on faces of peds and in pores; slightly alkaline; clear smooth boundary.

Bt3—22 to 30 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, firm, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline; clear smooth boundary.

C—30 to 60 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; slightly alkaline.

Depth to effervescent horizons is 40 to 60 inches or more.

The A horizon texture is fine sandy loam or sandy clay loam.

Reaction in the Bt horizon is neutral or slightly alkaline.

The C horizon texture is sandy loam or fine sandy loam.

## Recluse Series

The Recluse series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical pedon of Recluse loam, 0 to 6 percent slopes, about 550 feet north and 2,050 feet east of the southwest corner of section 4, T. 47 N., R. 74 W.; USGS topographic quadrangle Double Tanks, WY; 44 degrees 4 minutes 25 seconds north latitude and 105 degrees 45 minutes 41 seconds west longitude.

A—0 to 5 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; neutral (pH 6.8); abrupt smooth boundary.

Bt1—5 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and medium angular blocky; hard, friable, moderately sticky and moderately plastic; few distinct discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; neutral (pH 7.0); clear wavy boundary.

Bt2—12 to 17 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium angular blocky; hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; neutral (pH 7.2); abrupt wavy boundary.

Btk—17 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; slightly alkaline (pH 7.8); clear wavy boundary.

Bk1—23 to 42 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline (pH 8.4); gradual wavy boundary.

Bk2—42 to 60 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline (pH 8.4).

The mollic epipedon is 8 to 15 inches thick and commonly includes the upper part of the argillic horizon. Depth to calcium carbonate accumulations ranges from 17 to 27 inches.

The Bk horizon texture is loam or clay loam.

## Renohill Series

The Renohill series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium and residuum derived from shale. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Haplargids

Typical pedon of Renohill clay loam, in an area of Ulm-Renohill clay loams, 0 to 6 percent slopes, about 200 feet east and 1,000 feet north of the southwest corner of section 21, T. 42 N., R. 70 W.; USGS topographic quadrangle Teckla, WY; 43 degrees 35 minutes 42 seconds north latitude and 105 degrees 16 minutes 58 seconds west longitude.

A—0 to 4 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine and fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots throughout; neutral; clear smooth boundary.

Bt1—4 to 9 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline; clear smooth boundary.

Bt2—9 to 19 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; strong medium prismatic structure parting to strong fine angular blocky; hard, very firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; moderately alkaline; clear smooth boundary.

Btk—19 to 24 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine and medium prismatic structure

parting to moderate fine and medium angular blocky; slightly hard, firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—24 to 35 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, firm, moderately sticky and moderately plastic; many very fine and fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr—35 to 60 inches; soft calcareous shale.

Depth to calcium carbonate accumulations ranges from 12 to 19 inches. Depth to bedrock ranges from 20 to 40 inches.

The A horizon texture is clay loam or loam.

The Bt, Btk, and Bk horizon textures are clay loam or clay. Reaction is slightly alkaline or moderately alkaline in the Bt and Btk horizons.

## Rockybutte Series

The Rockybutte series consists of very deep, well drained soils on plateaus and ridges. The soils formed in alluvium or loess over residuum weathered from porcelanite. Slopes range from 0 to 10 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Rockybutte loam, in an area of Brislaw-Rockybutte-Ironbutte complex, 0 to 10 percent slopes, about 2,500 feet west and 500 feet south of the northeast corner of section 18, T. 56 N., R. 71 W.; USGS topographic quadrangle Rocky Butte SW, WY; 44 degrees 55 minutes 13 seconds north latitude and 105 degrees 26 minutes 25 seconds west longitude.

A—0 to 4 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots;

common fine pores; 5 percent angular porcelanite channers; neutral (pH 6.8); clear smooth boundary.

- Bt1—4 to 10 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; slightly hard, friable, moderately sticky and moderately plastic; common distinct discontinuous dark brown (7.5YR 3/3) clay films on faces of peds and in pores; 10 percent angular porcelanite channers; neutral; (pH 7.2); gradual wavy boundary.
- Bt2—10 to 16 inches; brown (7.5YR 4/4) channery clay loam, dark brown (7.5YR 3/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, very friable, moderately sticky and moderately plastic; common distinct discontinuous dark brown (7.5YR 3/3) clay films on faces of peds and in pores; 20 percent angular porcelanite channers; slightly alkaline; (pH 7.4); clear wavy boundary.
- Btk—16 to 23 inches; brown (7.5YR 5/4) very channery clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable; common distinct discontinuous dark brown (7.5YR 3/3) clay films on faces of peds and in pores; few fine irregular light gray (10YR 7/2) carbonate threads throughout; 35 percent angular porcelanite channers; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.
- Bk—23 to 29 inches; brown (7.5YR 5/4) extremely channery loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable; few distinct discontinuous light gray (10YR 7/2) carbonate coats on bottom surfaces of rock fragments; few fine irregular light gray (10YR 7/2) carbonate threads throughout; 60 percent angular porcelanite channers; strongly effervescent; moderately alkaline (pH 8.2); clear wavy boundary.
- 2C—29 to 60 inches; fractured porcelanite with 7 percent sandy loam filling interstices and voids, brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) moist; massive; few distinct discontinuous light gray (10YR 7/2) carbonate coats on bottom surfaces of rock fragments; 65 percent angular porcelanite channers, 20 percent subangular porcelanite flagstones, and 8 percent subrounded stones; slightly effervescent but variable; soil matrix is noneffervescent but contains few segregated masses or threads of calcium carbonates.

Depth to calcium carbonate accumulations ranges from 18 to 31 inches. The depth to a fragmental discontinuity is 20 to 40 inches.

Rock fragments in the A horizon range from 0 to 14 percent angular porcelanite channers.

The Bt1 horizon texture is loam or clay loam. Rock fragments range from 0 to 14 percent porcelanite channers.

The Bt2 horizon texture is channery loam or very channery clay loam. Reaction is slightly alkaline to moderately alkaline. Rock fragments range from 15 to 50 percent porcelanite channers.

The Btk horizon texture is channery or very channery loam or clay loam. Rock fragments range from 15 to 50 percent porcelanite channers.

The Bk horizon texture is very or extremely channery loam. Reaction is slightly alkaline or moderately alkaline. Rock fragments range from 35 to 75 percent channers and 0 to 5 percent flagstones.

The C horizon texture is fractured porcelanite with less than 10 percent of interstices or voids filled with sandy loam. Reaction is neutral or slightly alkaline. Rock fragments range from 60 to 95 percent channers, 0 to 15 percent flagstones, and 0 to 5 percent stones.

## Rockypoint Series

The Rockypoint series consists of very deep, well and moderately well drained soils on flood plains and stream terraces. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents

Typical pedon of Rockypoint loam, in an area of Rockypoint-lwait association, 0 to 6 percent slopes, about 1,160 feet west and 2,350 feet south of the northeast corner of section 2, T. 51 N., R. 75 W.; 44 degrees 25 minutes 36 seconds north latitude and 105 degrees 50 minutes 13 seconds west longitude.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, brown (10YR 4/3) moist; weak fine platy structure; slightly hard, friable, sticky and slightly plastic; common fine and very fine and few coarse and medium roots; slightly effervescent; calcium carbonate disseminated; slightly alkaline (pH 7.6); clear smooth boundary.

C1—3 to 30 inches; pale brown (10YR 6/3) clay loam, stratified with thin layers of sandy loam, loam, silt loam, and silty clay loam, brown (10YR 5/3) moist; massive; hard, friable, sticky and plastic; common fine and very fine and few coarse and medium roots to about 25 inches, few fine and very fine roots below; slightly effervescent; calcium carbonate disseminated; moderately alkaline (pH 8.0); clear smooth boundary.

C2—30 to 60 inches; pale brown (10YR 6/3) loam, stratified with thin layers of loamy sand, sandy loam, very fine sandy loam, and clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and plastic; few fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline (pH 8.2).

Depth to continuous accumulations of carbonate is 0 to 10 inches. Rock fragments range from 0 to 10 percent.

Electrical conductivity ranges from 0 to 2 millimhos per centimeter in the A horizon.

The C horizon texture is clay loam or loam, stratified with thin layers of very fine sandy loam, sandy loam, silt loam, silty clay loam, and loamy sand. Reaction is slightly alkaline to moderately alkaline. Electrical conductivity ranges from 4 to 8 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Sabatka Series

The Sabatka series consists of moderately deep, well drained soils on ridges and hills. The soils formed in residuum or alluvium over residuum derived from noncalcareous shale. Slopes range from 3 to 30 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Haplustepts

Typical pedon of Sabatka clay loam, about 1,750 feet east and 200 feet south of the northwest corner of section 33, T. 57 N., R. 69 W.; USGS topographic quadrangle Mittenbutte, WY; 44 degrees 52 minutes 20 seconds north latitude and 105 degrees 8 minutes 39 seconds west longitude.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine and medium angular blocky structure; very hard, firm, moderately sticky and moderately plastic; neutral; clear smooth boundary.

Bw—3 to 19 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure parting to strong fine and medium angular blocky; extremely hard, very firm, very sticky and very plastic; neutral; clear wavy boundary.

C—19 to 30 inches; dark olive gray (5Y 3/2) clay, black (5Y 2/2) moist; moderate fine and medium angular blocky structure; very hard, firm, moderately sticky and moderately plastic; neutral; abrupt wavy boundary.

Cr—30 to 60 inches; noncalcareous clayey shale.

Depth to bedrock ranges from 20 to 40 inches.

Some pedons have up to 25 percent channers on the surface of the A horizon.

The Bw and C horizon textures are clay or clay loam.

Reaction in the C horizon is slightly acid to slightly alkaline. One to two percent authigenic gypsum occurs in some pedons. Sodium adsorption ratio is 0 to 5.

### Samday Series

The Samday series consists of shallow, well drained soils on hills and ridges. The soils formed in residuum derived from shale. Slopes range from 3 to 45 percent. Elevation is 4,100 to 5,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Clayey, smectitic, calcareous, mesic, shallow Ustic Torriorthents

Typical pedon of Samday clay loam, in an area of Samday-Savageton clay loams, 3 to 15 percent slopes, about 1,900 feet south and 2,100 feet west of the northeast corner of section 7, T. 47 N., R. 71 W.

A—0 to 2 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; many fine and very fine roots; slightly alkaline; clear smooth boundary.

C—2 to 16 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, very sticky and very plastic; common fine and very fine roots; strongly effervescent; calcium carbonate mostly disseminated; moderately alkaline; clear wavy boundary.

Cr—16 to 60 inches; soft effervescent shale.

Depth to bedrock ranges from 7 to 20 inches.

Depth to effervescent layers ranges from 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline. Electrical conductivity ranges from 0 to 2 millimhos per centimeter.

The C horizon texture is silty clay or clay. Reaction is slightly alkaline or moderately alkaline. Rock fragments range from 0 to 15 percent hard shale channers. One percent authigenic gypsum occurs in some pedons. Electrical conductivity ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Samsil Series

The Samsil series consists of shallow, well drained soils on ridges or hills. The soils formed in residuum derived from shale. Slopes range from 3 to 45 percent. Elevation is 4,100 to 5,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Clayey, smectitic, calcareous, mesic, shallow Aridic Ustorthents

Typical pedon of Samsil clay loam, about 2,100 feet south and 1,450 feet east of the northwest corner of section 32, T. 56 N., R. 72 W.; USGS topographic quadrangle Whitetail Butte, WY; 44 degrees 47 minutes 43 seconds north latitude and 105 degrees 32 minutes 55 seconds west longitude.

A—0 to 4 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; hard, firm, very sticky and very plastic; many very fine and fine roots throughout; many very fine and fine pores; slightly effervescent; neutral; clear smooth boundary.

C—4 to 15 inches; light yellowish brown (2.5Y 6/4) clay, light yellowish brown (2.5Y 6/3) moist; strong medium and coarse angular blocky structure; very hard, firm, very sticky and very plastic; many very fine and fine roots throughout; many very fine and fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; 5 percent gravel; moderately alkaline; gradual wavy boundary.

Cr—15 to 60 inches; soft calcareous shale interbedded with mudstone and sandstone.

Depth to bedrock ranges from 6 to 20 inches. Depth to effervescent layers ranges from 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The C horizon texture is clay or clay loam. Reaction is slightly alkaline or moderately alkaline. Rock fragments range from 5 to 40 percent hard shale channers. One percent authigenic gypsum occurs in some pedons.

### Savageton Series

The Savageton series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum derived from shale. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Haplocambids

Typical pedon of Savageton clay loam, in an area of Samday-Savageton clay loams, 3 to 15 percent slopes, about 1,000 feet west and 1,200 feet south of the northeast corner of section 21, T. 49 N., R. 73 W.

A—0 to 5 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium and fine granular structure; slightly hard, firm, sticky and plastic; few coarse and medium and many fine roots; slightly alkaline; clear wavy boundary.

Bw—5 to 15 inches; light brownish gray (2.5Y 6/2) clay, light olive brown (2.5Y 5/4) moist; weak medium and fine prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, very sticky and plastic; few coarse and medium and common fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear wavy boundary.

Bk—15 to 28 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; few coarse, medium, and fine roots; strongly effervescent; few to common fine irregularly shaped filaments and threads of calcium carbonate and fine crystals of gypsum; strongly alkaline; gradual wavy boundary.

Cr—28 to 60 inches; soft interbedded sandy and silty shale.

Depth to calcium carbonate accumulations ranges from 0 to 6 inches. Depth to bedrock ranges from 20 to 40 inches.

Reaction in the A horizon is slightly or moderately alkaline.

The Bw horizon texture is clay or clay loam.

The Bk horizon texture is clay or clay loam. One percent authigenic gypsum occurs in some pedons. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Shingle Series

The Shingle series consists of shallow, well drained soils on hills and ridges. The soils formed in residuum derived from shale and sandstone. Slopes range from 3 to 60 percent. Elevation is 4,100 to 5,800 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

Typical pedon of Shingle loam, in an area of Theedle-Shingle loams, 3 to 30 percent slopes, about 800 feet south and 1,800 feet west of the northeast corner of section 36, T. 52 N., R. 76 W.; USGS topographic quadrangle Echeta, WY; 44 degrees 26 minute 42 seconds north latitude and 105 degrees 56 minutes 27 seconds west longitude.

A—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots throughout; slightly alkaline; clear smooth boundary.

C1—2 to 7 inches; light yellowish brown (10YR 6/4) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common fine and very fine roots throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—7 to 12 inches; very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and slightly plastic; common fine and very fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; moderately alkaline; abrupt smooth boundary.

Cr—12 to 60 inches; very pale brown (10YR 7/3) soft calcareous shale.

Depth to bedrock is 10 to 20 inches. Depth to calcium carbonate accumulations ranges from 0 to 6 inches.

The A horizon texture is loam or clay loam.

Reaction is neutral to moderately alkaline.

The C horizon texture is loam or clay loam.

Electrical conductivity ranges from 0 to 2 millimhos per centimeter.

### Silhouette Series

The Silhouette series consists of very deep, well drained soils on hills and ridges. The soils formed in alluvium derived from shale. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Haplocambids

Typical pedon of Silhouette clay loam, in an area of Savageton-Silhouette clay loams, 0 to 6 percent slopes, about 500 feet east and 850 feet south of the northwest corner of section 30, T. 42 N., R. 71 W.

A—0 to 2 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; few medium and many fine and very fine roots; slightly alkaline; abrupt wavy boundary.

Bw1—2 to 16 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, sticky and plastic; few medium and common fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear wavy boundary.

Bw2—16 to 28 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, sticky and plastic; few medium, fine, and very fine roots; strongly effervescent; few medium and fine irregularly shaped threads of calcium carbonate; moderately alkaline; clear wavy boundary.

Bk—28 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm, sticky and plastic; few medium, fine, and very fine roots; strongly effervescent; many medium and fine irregularly shaped threads and masses of calcium carbonate; moderately alkaline.

Depth to calcium carbonate accumulations ranges from 0 to 8 inches.

The Bw horizon texture is clay or clay loam.

Reaction is slightly alkaline or moderately alkaline.

The Bk horizon texture is silty clay loam, clay loam, or clay. Electrical conductivity ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Sodawells Series

The Sodawells series consists of very deep, well drained soils on flood plains and stream terraces. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 3 percent. 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 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents  
 Typical pedon of Sodawells fine sandy loam, about 2,500 feet south and 300 feet west of the northeast corner of section 19, T. 54 N., R. 60 W.; USGS topographic quadrangle Weston, WY; 44 degrees 39 minutes 2 seconds north latitude and 105 degrees 18 minutes 41 seconds west longitude.

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine and common medium roots throughout; many very fine and fine pores; neutral; clear wavy boundary.

C1—5 to 40 inches; light yellowish brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; stratified with thin layers of silt loam, loamy fine sand, and very fine sandy loam; moderate fine and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; many very fine and fine pores; strongly effervescent; 1 percent gravel; slightly alkaline

C2—40 to 80 inches; light yellowish brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; stratified with thin layers of silt loam, loamy fine sand, and very fine sandy loam; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations and few fine prominent gray (10YR 6/1) redoximorphic depletions; massive; slightly hard, very friable, nonsticky and nonplastic; strongly effervescent; 1 percent gravel; slightly alkaline.

Depth to calcium carbonates ranges from 0 to 8 inches. Rock fragments range from 0 to 5 percent. Flooding is rare to frequent for very brief or brief periods.

Reaction in the A horizon is neutral to moderately alkaline.

Reaction in the C horizon is slightly alkaline to strongly alkaline.

### Spottedhorse Series

The Spottedhorse series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum or alluvium over residuum derived primarily from shale. Slopes range from 0 to 6 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Aridic Paleustalfs

Typical pedon of Spottedhorse loam, in an area of Jaywest-Spottedhorse loams, 0 to 6 percent slopes, about 600 feet north and 2,300 feet east of the southwest corner of section 5, T. 55 N., R. 74 W.; USGS topographic quadrangle Reservoir Creek, WY; 44 degrees 46 minutes 4 seconds north latitude and 105 degrees 47 minutes 35 seconds west longitude.

E—0 to 4 inches; light brownish gray (10YR 6/2) loam, brown (10YR 4/3) moist; strong medium, thin, and very thin platy structure; slightly hard, very friable, nonsticky and slightly plastic; thin vesicular crust on soil surface; many fine and very fine roots throughout; neutral (pH 7.0); abrupt smooth boundary.

Bt—4 to 13 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 3/4) moist; strong medium prismatic structure parting to strong medium and fine angular blocky; extremely hard, very firm, very sticky and very plastic; many very fine and fine roots; few prominent dark brown

(10YR 3/3) clay films on faces of peds and lining pores and root channels; neutral (pH 7.2); clear smooth boundary.

Btk—13 to 27 inches; light brownish gray (10YR 6/2) clay loam, brown (10YR 5/3) moist; strong coarse prismatic structure parting to strong medium and fine angular blocky; very hard, firm, moderately sticky and moderately plastic; many fine and very fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds and in pores; strongly effervescent; common fine irregular light gray (10YR 7/2) threads of calcium carbonate; moderately alkaline (pH 8.4); clear smooth boundary

Bk—27 to 35 inches; light gray (10YR 7/2) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common fine roots; strongly effervescent; common fine irregular very pale brown (10YR 8/2) threads of calcium carbonate; moderately alkaline (pH 8.4); clear wavy boundary.

Cr—35 to 60 inches; soft shale; slightly effervescent in the upper 9 inches and noneffervescent below.

Depth to bedrock ranges from 20 to 40 inches.

Depth to accumulations of calcium carbonate ranges from 12 to 19 inches.

Reaction in the E horizon is slightly acid or neutral.

The Bt horizon texture is clay loam or clay.

Reaction is neutral or slightly alkaline.

The Btk horizon texture is clay loam or clay.

Reaction is slightly alkaline or moderately alkaline.

Electrical conductivity in the Bk horizon ranges from 2 to 4 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Taluce Series

The Taluce series consists of shallow, well drained soils on ridges and hills. The soils formed in residuum derived from sandstone. Slopes range from 3 to 40 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

Typical pedon of Taluce fine sandy loam, in an area of Turnercrest-Keeline-Taluce fine sandy loams, 6 to 30 percent slopes, about 2,400 feet east and 1,900 feet north of the southwest corner of section 21, T. 45 N., R. 75 W.

A—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; carbonates are disseminated throughout; strongly effervescent; slightly alkaline; clear smooth boundary.

C—2 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; carbonates are disseminated throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

Cr—14 to 60 inches; soft calcareous sandstone.

Depth to bedrock ranges from 10 to 20 inches.

Depth to calcium carbonate accumulations ranges from 0 to 4 inches.

The A horizon texture is sandy loam or fine sandy loam. Reaction is neutral to moderately alkaline.

The C horizon texture is sandy loam or fine sandy loam. Reaction is moderately alkaline or strongly alkaline. Rock fragments range from 0 to 5 percent.

**Note:** The Taluce soil in map units 114, 140, 150, and 161 are taxadjuncts to the Taluce series. The soil in these map units is slightly acid or neutral throughout, and is noneffervescent in the C horizon. These soils are loamy, mixed, superactive, nonacid, mesic, shallow Ustic Torriorthents.

## Teckla Series

The Teckla series consists of very deep, well drained soils on terraces and mesas. The soils formed in alluvium or eolian deposits over residuum weathered from porcelanite. Slopes range from 0 to 6 percent. Elevation is 4,200 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Teckla very fine sandy loam, 0 to 10 percent slopes, about 2,000 feet north and 2,500 feet east of the southwest corner of section 36, T. 43 N., R. 70 W.; 43 degrees 39 minutes 4 seconds north latitude and 105 degrees 14 minutes 2 seconds west longitude.

A—0 to 5 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak thin platy structure parting to weak fine granular; soft, very friable; many fine and very fine roots; neutral (pH 6.6); clear smooth boundary.

AB—5 to 10 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; moderate medium angular blocky structure; slightly hard, friable; few fine and many very fine roots; neutral (pH 6.8); clear smooth boundary.

Bt—10 to 23 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium and fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and many very fine roots; many faint clay films bridging sand grains; neutral (pH 7.0); clear smooth boundary.

2Bt—23 to 31 inches; brown (7.5YR 5/4) channery loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 20 percent medium and fine angular porcelanite channers; many prominent clay films on faces of peds; slightly alkaline (pH 7.0); clear wavy boundary.

2Bk—31 to 45 inches; light reddish brown (5YR 6/4) very channery loam, reddish brown (5YR 4/4) moist; massive; soft, very friable; common fine and very fine roots; 40 percent medium and fine angular porcelanite channers; strongly effervescent; calcium carbonate disseminated and in masses; strongly alkaline (pH 9.0); clear wavy boundary.

2C—45 to 60 inches; light reddish brown (2.5YR 6/4) extremely channery sandy loam, red (2.5YR 5/6) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 45 percent angular channers, 15 percent cobbles, and 5 percent stones; soil matrix is noneffervescent but contains few segregated masses of calcium carbonate; slightly alkaline (pH 7.8).

Depth to calcium carbonate accumulations ranges from 20 to 31 inches. Depth to a fragmental discontinuity: 20 to 40 inches

The Bt horizon texture is clay loam or sandy clay loam. Reaction is neutral or slightly alkaline. Rock fragments range from 0 to 15 percent porcelanite channers.

The 2Bt horizon texture is channery loam or channery clay loam. Reaction is neutral or slightly alkaline. Rock fragments range from 15 to 25 percent porcelanite channers.

The 2Bk horizon texture is very channery loam or very channery sandy loam. Rock fragments range from 35 to 45 percent angular porcelanite channers and 0 to 5 percent cobbles.

The C horizon texture is extremely channery sandy loam or loamy sand. Reaction is neutral or moderately alkaline. Rock fragments range from 50 to 90 percent, of which 40 to 60 percent are channers, 0 to 15 percent cobbles, and 0 to 5 percent stones.

## Terro Series

The Terro series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium and residuum derived from sandstone. Slopes range from 2 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Terro fine sandy loam, in an area of Vonalee-Terro fine sandy loams, 2 to 10 percent slopes, about 150 feet south and 1,200 feet east of the northwest corner of section 3, T. 42 N., R. 72 W.

A—0 to 3 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

Bt—3 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay bridging between sand grains; neutral; clear wavy boundary.

Btk—10 to 16 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few distinct discontinuous dark brown (10YR 3/3) clay bridging between sand grains; carbonates are disseminated throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—16 to 23 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; carbonates are disseminated throughout; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Cr—23 to 60 inches; soft calcareous sandstone.

Depth to calcium carbonate accumulations ranges from 15 to 20 inches. Depth to bedrock ranges from 20 to 40 inches.

The A, Bt, Btk, and Bk horizon textures are sandy loam or fine sandy loam. Reaction is neutral or slightly alkaline in the A horizon and slightly alkaline or moderately alkaline in the Btk and Bk horizons.

### Theedle Series

The Theedle series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum or alluvium over residuum derived from mixed sources. Slopes range from 0 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents

Typical pedon of Theedle loam, in an area of Cushman-Theedle loams, 0 to 6 percent slopes, about 2,050 feet south and 1,900 feet east of the northwest corner of section 10, T. 47 N., R. 71 W.; USGS topographic quadrangle The Gap SW, WY; 44 degrees 4 minutes 2 seconds north latitude and 105 degrees 22 minutes 30 seconds west longitude

A—0 to 2 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; carbonates are disseminated throughout; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—2 to 12 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—12 to 28 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, firm, moderately sticky and moderately plastic; many fine irregular light gray (10YR 7/2) carbonate threads throughout; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—28 to 60 inches; soft calcareous shale.

Depth to bedrock ranges from 20 to 40 inches. Depth to calcium carbonate accumulations ranges from 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The Bk horizon texture is clay loam or loam. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Torriarents

Torriarents consist of deep, well and somewhat excessively drained soils on hills and ridges. The soils formed in overburden derived from mining operations. Slopes range from 2 to 20 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 45 to 49 degrees, and the frost-free period is 105 to 130 days.

Taxonomic Class: Torriarents

Typical pedon of Torriarents, in an area of Torriarents-Torriorthents complex, reclaimed; about 1,200 feet east and 1,300 feet south of the northwest corner of section 16, T. 43 N., R. 70 W.; USGS topographic quadrangle Reno Reservoir, WY; 43 degrees 42 minutes 18 seconds north latitude and 105 degrees 16 minutes 35 seconds west longitude.

A—0 to 4 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; slightly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

C1—4 to 42 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive; hard, firm, moderately sticky and moderately plastic; common very fine and fine roots throughout; 10 percent by volume argillic horizon fragments with few fine distinct brown (10YR 4/3) clay films on ped faces; strongly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

C2—42 to 60 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; strongly effervescent (pH 8.0); moderately alkaline.

Depth to calcium carbonate accumulations ranges from 0 to 6 inches. Rock fragments range from 0 to 5 percent. Electrical conductivity ranges from 0 to 2 millimhos per centimeter.

The A horizon texture is variable, but commonly is fine sandy loam, loam, or clay loam. Reaction is slightly alkaline or moderately alkaline.

The C horizon texture is variable, but commonly is fine sandy loam, loam, clay loam, or sandy clay loam. Reaction is slightly alkaline or moderately alkaline. Sodium adsorption ratio is 0 to 5.

### Torriorthents

Torriorthents consist of deep, well and somewhat excessively drained soils on hills and ridges. The soils formed in overburden derived from mining operations. Slopes range from 2 to 20 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 45 to 49 degrees, and the frost-free period is 105 to 130 days.

Taxonomic Class: Torriorthents

Typical pedon of Torriorthents, in an area of Torriorthents-Torriorthents complex, reclaimed; about 200 feet west and 1,900 feet north of the southeast corner of section 28, T. 50 N., R. 71 W.; USGS topographic quadrangle Gillette East, WY; 44 degrees 16 minutes 54 seconds north latitude and 105 degrees 23 minutes 19 seconds west longitude.

A—0 to 5 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—5 to 44 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, moderately sticky and moderately plastic; common very fine and fine roots throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—44 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; strongly effervescent; moderately alkaline.

Depth to calcium carbonate accumulations ranges from 0 to 6 inches. Rock fragments range from 0 to 5 percent. Electrical conductivity ranges from 0 to 2 millimhos per centimeter.

The A horizon texture is variable, but commonly is fine sandy loam, loam, or clay loam. Reaction is slightly alkaline or moderately alkaline.

The C horizon texture is variable, but commonly is fine sandy loam, loam, clay loam, or sandy clay loam. Reaction is slightly alkaline or moderately alkaline. Sodium adsorption ratio is 0 to 5.

### Tullock Series

The Tullock series consists of moderately deep, excessively drained soils on ridges, hills, and dunes. The soils formed in eolian deposits over residuum derived from sandstone. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees, and the frost-free period is 105 to 130 days.

Taxonomic Class: Mixed, mesic Ustic Torripsamments

Typical pedon of Tullock loamy sand, in an area of Keeline-Tullock loamy sands, 6 to 30 percent slopes, about 2,100 feet west and 2,500 feet south of the northeast corner of section 31, T. 46 N., R. 74 W.

A—0 to 4 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; single grain; loose, friable, nonsticky and nonplastic; neutral; clear smooth boundary.

C—4 to 28 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grain; soft, friable, nonsticky and nonplastic; carbonates are disseminated throughout; slightly effervescent; slightly alkaline; clear smooth boundary.

Cr—28 to 60 inches; soft calcareous sandstone.

Depth to bedrock ranges from 20 to 40 inches. Depth to calcium carbonate accumulations ranges from 0 to 6 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The C horizon texture is loamy sand, loamy fine sand, or sand. Reaction is slightly alkaline or moderately alkaline.

### Turnercrest Series

The Turnercrest series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum and eolian material derived from sandstone. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torriorthents

Typical pedon of Turnercrest sandy loam, in an area of Turnercrest-Keeline-Taluze fine sandy loams, 6 to 30 percent slopes, about 900 feet south and

1,100 feet west of the northeast corner of section 7, T. 42 N., R. 73 W.

A—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; strongly effervescent; calcium carbonate disseminated throughout; moderately alkaline; clear smooth boundary.

Bk1—2 to 7 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and very fine roots; strongly effervescent; calcium carbonate disseminated throughout; moderately alkaline; clear wavy boundary.

Bk2—7 to 32 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; slightly effervescent; calcium carbonate disseminated throughout; moderately alkaline; gradual wavy boundary.

Cr—32 to 60 inches; soft, medium and fine grained sandstone.

Depth to calcium carbonate accumulations ranges from 0 to 4 inches. Depth to bedrock ranges from 20 to 40 inches.

The A horizon texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. Reaction is slightly alkaline or moderately alkaline.

The Bw horizon texture is sandy loam or fine sandy loam.

The C horizon texture is sandy loam, fine sandy loam, or loamy fine sand.

**Note:** The Turnercrest soil in map unit 150 is a taxadjunct to the Turnercrest series. The soil in this map unit is noneffervescent throughout, and reaction is slightly acid or neutral. These soils are coarse-loamy, mixed, superactive, nonacid, mesic Ustic Torriorthents.

## Ucross Series

The Ucross series consists of moderately deep, well drained soils on hills and ridges. The soils formed in residuum or alluvium over residuum derived from mixed sedimentary sources. Slopes range from 0 to 30 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents

Typical pedon of Ucross loam, in an area of Ucross-Iwait-Fairburn loams, 3 to 30 percent slopes, about 50 feet south and 25 feet west of the northeast corner section 9, T. 55 N., R. 74 W.; USGS topographic quadrangle Reservoir Creek WY; 44 degrees 45 minutes 58 seconds north latitude and 105 degrees 45 minutes 34 seconds west longitude

A—0 to 5 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate fine and medium granular structure; slightly hard, firm, nonsticky and nonplastic; many very fine and fine and common medium roots throughout; many fine pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—5 to 17 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine and common medium roots throughout; many fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—17 to 31 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine roots throughout; common fine pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; strongly alkaline; abrupt wavy boundary.

Cr—31 to 60 inches; light yellowish brown (10YR 6/4) soft calcareous shale interbedded with mudstones and sandstone.

Depth to paralithic contact is 20 to 40 inches. Depth to calcium carbonate accumulations is 0 to 6 inches.

Reaction in the A horizon is neutral to moderately alkaline.

The Bk horizon texture is loam or clay loam. Reaction is slightly alkaline or moderately alkaline. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Ulm Series

The Ulm series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed

sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Haplargids

Typical pedon of Ulm clay loam, 0 to 6 percent slopes, about 2,300 feet west and 2,500 feet north of the southeast corner of section 21, T. 48 N., R. 72 W.; USGS topographic quadrangle Scaper Reservoir, WY; 44 degrees 7 minutes 17 seconds north latitude and 105 degrees 30 minutes 48 seconds west longitude.

- A—0 to 4 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong fine granular structure; slightly hard, friable, sticky and plastic; many fine and few medium roots; neutral (pH 7.0); clear smooth boundary.
- Bt—4 to 15 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong medium and coarse angular blocky; very hard, very firm, very sticky and very plastic; common fine and few medium roots; many prominent clay films on faces of peds; neutral (pH 7.2); clear wavy boundary.
- Btk—15 to 25 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; common fine and few medium roots; common distinct clay films on faces of peds; slightly effervescent; calcium carbonate mostly disseminated with few prominent masses; slightly alkaline (pH 7.6); clear wavy boundary.
- Bk1—25 to 33 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few medium and fine roots; strongly effervescent; common fine seams, streaks, and masses of calcium carbonate; moderately alkaline (pH 8.2); clear wavy boundary.
- Bk2—33 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few fine roots; distinct seams, streaks, and masses of calcium carbonate; 5 percent partially weathered shale and soft sandstone channers; moderately alkaline (pH 8.4).

Depth to calcium carbonate accumulations ranges from 12 to 33 inches.

The A horizon texture is loam or clay loam.

The Bt and Btk horizon textures are clay, clay loam, silty clay, or silty clay loam. Reaction is neutral or slightly alkaline in the Bt horizon and slightly alkaline or moderately alkaline in the Btk horizon.

The Bk horizon texture is clay loam, loam, or silty clay loam. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Ustic Torriorthents

Ustic Torriorthents consist of shallow, moderately deep and deep, well drained and excessively drained soils on hills and ridges. The soils formed in alluvium, alluvium over residuum, or residuum derived from sandstone and shale. Slopes range from 10 to 100 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 17 inches, the average annual air temperature is 45 to 49 degrees, and the frost-free period is 105 to 130 days.

Taxonomic Class: Ustic Torriorthents

- A—0 to 4 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots throughout; slightly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.
- Bk—4 to 35 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; strongly effervescent; moderately alkaline (pH 8.4); abrupt smooth boundary.
- Cr—35 to 60 inches; weathered shale bedrock.

Depth to paralithic contact is 4 to 30 inches in mapping unit 234. Depth to paralithic contact is 30 to 60 inches in mapping unit 233. Depth to calcium carbonate accumulations ranges from 0 to 6 inches. Rock fragments range from 0 to 10 percent. Electrical conductivity ranges from 0 to 2 millimhos per centimeter.

The A horizon texture is highly variable within short distances and commonly is fine sandy loam, loam, or clay loam. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon texture is highly variable within short distances, but commonly is clay loam, loam, clay, fine sandy loam, sandy loam, or sandy clay loam. Reaction is slightly alkaline or moderately alkaline. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

### Valent Series

The Valent series consists of very deep, excessively drained soils on dunes. The soils formed in eolian deposits. Slopes range from 3 to 20 percent. Elevation is 4,000 to 4,500 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost free period is 105 to 130 days.

Taxonomic Class: Mixed, mesic Aridic Ustipsamments

Typical pedon of Valent loamy sand about 2,200 feet west and 1,200 feet north of the southeast corner of section 29, T. 55 N., R. 73 W.; USGS topographic quadrangle Recluse, WY; 44 degrees 42 minutes 42 seconds north latitude and 105 degrees 40 minutes 1 second west longitude.

A—0 to 3 inches; brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; moderate thin platy structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; common fine low continuity vesicular pores; neutral; clear smooth boundary.

C1—3 to 9 inches; brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; common fine low continuity interstitial pores; noneffervescent; neutral; clear wavy boundary.

C2—9 to 23 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; common fine low continuity interstitial pores; neutral; clear wavy boundary.

C3—23 to 60 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots throughout; neutral.

Reaction in the A and C horizons is neutral or slightly alkaline.

### Vonalee Series

The Vonalee series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived from sandstone. Slopes range from 0 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Vonalee fine sandy loam, about 600 feet east and 250 feet north of the southwest corner of section 9, T. 41 N., R. 72 W.; USGS topographic quadrangle Turnercrest SE, WY; 43 degrees 2 minutes 2 seconds north latitude and 105 degrees 1 minute 15 seconds west longitude.

A—0 to 3 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots throughout; neutral; clear smooth boundary.

Bt1—3 to 12 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay bridging between sand grains; neutral; clear smooth boundary.

Bt2—12 to 24 inches; light yellowish brown (10YR 6/4) fine sandy loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; few distinct discontinuous dark brown (10YR 3/3) clay bridging between sand grains; slightly alkaline; clear smooth boundary.

Bk1—24 to 29 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; carbonates are disseminated throughout; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk2—29 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly

hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

Depth to calcium carbonate accumulations ranges from 11 to 40 inches.

The A, Bt, and Bk horizon textures are fine sandy loam or sandy loam. Reaction is neutral or slightly alkaline in the A horizon, neutral to moderately alkaline in the Bt horizon, and slightly alkaline to moderately alkaline in the Bk horizon.

### Vonalf Series

The Vonalf series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium and eolian deposits derived primarily from sandstone. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Vonalf fine sandy loam, in an area of Vonalf-Xema fine sandy loams, 3 to 10 percent slopes, about 200 feet east and 2,440 feet north of the southwest corner of section 7, T. 48 N., R. 73 W.; USGS topographic quadrangle Four Bar J Ranch, WY; 44 degrees 9 minutes 6 seconds north latitude and 105 degrees 41 minutes 18 seconds west longitude.

A—0 to 6 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; slightly alkaline; clear smooth boundary.

Bt1—6 to 16 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots throughout; common distinct discontinuous brown (10YR 4/3) clay bridges between sand grains; slightly alkaline (pH 7.8); clear smooth boundary.

Bt2—16 to 34 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; few distinct discontinuous brown (10YR 4/3) clay bridges between sand grains; slightly alkaline (pH 7.8); clear smooth boundary.

Bk—34 to 60 inches; light yellowish brown (2.5Y 6/4) fine sandy loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots throughout; strongly effervescent; few fine irregular light gray (10YR 7/2) carbonate threads and few fine rounded light gray (10YR 7/2) masses of carbonate throughout; moderately alkaline (pH 8.2).

Depth to calcium carbonate accumulations ranges from 14 to 40 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bt and Bk horizon textures are fine sandy loam or sandy loam. Reaction is neutral or slightly alkaline in the Bt horizon and slightly alkaline or moderately alkaline in the Bk horizon.

### Wags Series

The Wags series consists of moderately deep, well drained soils on hills and ridges. The soils formed in alluvium and residuum derived from shale. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degree F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, nonacid, mesic Ustic Torriorthents

Typical pedon of Wags clay loam, in an area of Hilight-Wags-Badland complex, 3 to 45 percent slopes, about 250 feet east and 1,050 feet north of the southwest corner of section 35, T. 44 N., R. 69 W.

A—0 to 1 inch; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine and very fine and few coarse and medium roots throughout; 10 percent angular shale channers; neutral (pH 6.6); abrupt smooth boundary.

C1—1 to 11 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; common fine and very fine and few medium and coarse roots throughout; 5 percent angular shale channers; slightly acid (pH 6.4); clear wavy boundary.

C2—11 to 23 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few medium, fine, and very fine roots throughout; 5 percent angular shale channers; slightly acid (pH 6.2); clear wavy boundary.

Cr—23 to 60 inches; grayish brown to dark gray soft nonacid shale.

Depth to bedrock ranges from 20 to 40 inches.

The A horizon texture is channery clay loam or clay. Reaction is neutral or slightly alkaline. It commonly has 5 to 35 percent selenite fragments on the soil surface.

The C horizon texture is clay or silty clay. Reaction is slightly acid to slightly alkaline. Rock fragments range from 0 to 60 percent channers. One to two percent authigenic gypsum occurs in some pedons.

## Wibaux Series

The Wibaux series consists of very deep, somewhat excessively drained soils on hills and ridges. The soils formed in alluvium and/or eolian deposits or residuum derived from porcelanite. Slopes range from 0 to 60 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Ustic Torriorthents

Typical pedon of Wibaux channery fine sandy loam, in an area of Wibaux, thick solum-Wibaux channery fine sandy loams, 3 to 40 percent slopes, about 1,600 feet west and 150 feet south of the northeast corner of section 14, T. 41 N., R. 70 W.; USGS topographic quadrangle Piney Canyon SW, WY; 43 degrees 32 minutes 3 seconds north latitude and 105 degrees 12 minutes 42 seconds west longitude.

A—0 to 3 inches; reddish brown (5YR 5/4) channery fine sandy loam, reddish brown (5YR 4/4) moist;

weak fine granular structure; soft, very friable, nonsticky and nonplastic; 25 percent angular porcelanite channers; slightly alkaline; clear wavy boundary.

C—3 to 16 inches; reddish brown (5YR 5/4) very channery loam, reddish brown (5YR 4/4) moist; massive; soft, friable, slightly sticky and slightly plastic; 55 percent angular porcelanite channers; slightly alkaline; clear wavy boundary

2C—16 to 60 inches; fractured porcelanite.

The soil is noneffervescent in the A horizon but may be weakly effervescent in the 2C horizon in some pedons. Depth to fragmental material ranges from 7 to 20 inches.

The A horizon texture is channery fine sandy loam, channery loam, or very channery loam. Reaction is neutral or slightly alkaline.

The C horizon texture is very channery loam, extremely channery loam, very channery sandy clay loam, or extremely channery sandy clay loam. Reaction is neutral or slightly alkaline.

The 2C horizon consists of fractured porcelanite material. It has 0 to 5 percent fine earth material between fractures. This horizon is 50 to 85 percent channers, 15 to 45 percent flagstones, and 0 to 5 percent stones.

**Note:** The Wibaux, thick solum, soils in map unit 243 are taxadjuncts to the Wibaux series. These soils have pedogenic accumulations of 1 to 5 percent calcium carbonate in some horizons above the porcelanite. Depth to fragmental material ranges from 20 to 40 inches.

The Bk horizon texture is very channery sandy loam, very channery fine sandy loam, or very channery loam. Reaction is moderately alkaline. These soils are loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Ustic Torriorthents.

## Worf Series

The Worf series consists of shallow, well drained soils on hills and ridges. The soils formed in residuum derived from interbedded sandstone and shale. Slopes range from 3 to 30 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Loamy, mixed, superactive, mesic, shallow Ustic Haplargids

Typical pedon of Worf loam, in an area of Cushman-Worf loams, 3 to 15 percent slopes, about 300 feet west and 2,380 feet south of the northeast corner of section 25, T. 46 N., R. 76 W.

A—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; clear smooth boundary.

Bt—2 to 10 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bk—10 to 18 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and few very fine roots; strongly effervescent; calcium carbonate disseminated throughout; moderately alkaline; clear smooth boundary.

Cr—18 to 60 inches; soft, effervescent sandy shale.

Depth to calcium carbonate accumulations ranges from 5 to 12 inches. Depth to bedrock ranges from 10 to 20 inches. Rock fragments range from 0 to 10 percent.

The A horizon texture is sandy loam or loam. Reaction is neutral or slightly alkaline.

The Bt horizon texture is loam, sandy clay loam, or clay loam. Reaction is neutral or slightly alkaline.

The Bk horizon texture is loam, sandy clay loam, or clay loam. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Worfka Series

The Worfka series consists of shallow, well drained soils on hills and ridges. The soils formed in alluvium and residuum from shale or interbedded shale and sandstone. Slopes range from 3 to 15 percent. Elevation is 4,100 to 5,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Clayey, smectitic, mesic, shallow Ustic Haplargids

Typical pedon of Worfka clay loam, in an area of Renohill-Worfka clay loams, 3 to 15 percent slopes, about 1,700 feet east and 2,490 feet north of the

southwest corner of section 5, T. 48 N., R. 70 W.; USGS topographic quadrangle Coyote Draw, WY; 44 degrees 10 minutes 2 seconds north latitude and 105 degrees 20 minutes 8 seconds west longitude.

A—0 to 2 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; hard, friable, sticky and plastic; many fine and very fine roots; neutral (pH 7.2); clear smooth boundary.

Bt—2 to 7 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure parting to moderate fine angular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; many prominent clay films on faces of peds; slightly alkaline (pH 7.4); clear smooth boundary.

Btk—7 to 13 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong medium angular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; few distinct clay films on faces of peds; strongly effervescent; calcium carbonate as few masses; moderately alkaline (pH 8.2); clear smooth boundary.

Bk—13 to 19 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; violently effervescent; calcium carbonate as common medium masses; moderately alkaline (pH 8.4); clear wavy boundary.

Cr—19 to 60 inches; soft calcareous shale.

Depth to accumulations of calcium carbonate ranges from 5 to 9 inches. Depth to bedrock ranges from 10 to 20 inches. Rock fragments range from 0 to 10 percent.

Reaction in the A horizon is neutral or slightly alkaline.

The Bt and Btk horizons textures are clay loam or clay.

Electrical conductivity in the Bk horizon ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Wyarno Series

The Wyarno series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium derived from shale. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14

inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine, smectitic, mesic Ustic Haplargids

Typical pedon of Wyarno clay loam, in an area of Wyarno-Ulm clay loams, 0 to 6 percent slopes, about 1,600 feet east and 1,400 feet south of the northwest corner of section 17, T. 42 N., R. 72 W.

A—0 to 3 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bt—3 to 8 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky; hard, friable, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly alkaline; clear smooth boundary.

Btk—8 to 12 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky; hard, firm, moderately sticky and moderately plastic; few distinct discontinuous dark brown (10YR 3/3) clay films on faces of peds and in pores; common fine irregular light gray (10YR 7/2) carbonate threads throughout; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—12 to 33 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—33 to 60 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; common fine irregular light gray (10YR 7/2) carbonate threads throughout; strongly effervescent; moderately alkaline.

Depth to accumulations of calcium carbonate ranges from 6 to 9 inches.

The Bt and Btk horizon textures are clay loam or clay.

Electrical conductivity in the Bk horizon ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Wyotite Series

The Wyotite series consists of very deep, well drained soils on alluvial fans and fan remnants. The soils formed in alluvium and eolian deposits derived from mixed sources. Slopes range from 0 to 6 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-silty, mixed, superactive, mesic Ustic Haplargids

Typical pedon of Wyotite loam, in an area of Wyotite-Ulm loams, 0 to 6 percent slopes, about 250 feet south and 250 feet east of the northwest corner of section 33, T. 43 N., R. 75 W.; USGS topographic quadrangle Rolling Pin Ranch, WY; 43 degrees 39 minutes 45 seconds north latitude and 105 degrees 53 minutes 9 seconds west longitude

A—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly acid (pH 6.2); abrupt smooth boundary.

Bt1—2 to 5 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium platy structure parting to weak medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine and fine roots; common faint clay films on faces of peds; slightly acid (pH 6.4); clear wavy boundary.

Bt2—5 to 13 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to strong medium and fine angular blocky; hard, friable, sticky and plastic; common fine and many very fine roots; many prominent and common distinct clay films on faces of peds; neutral (pH 6.6); abrupt wavy boundary.

Btk—13 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many faint and few prominent clay films on faces of peds; strongly effervescent; common medium and fine masses of calcium carbonate; slightly alkaline (pH 7.6); clear wavy boundary.

Bk1—22 to 38 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard,

friable, slightly sticky and plastic; few fine roots; strongly effervescent; common medium and fine seams and masses of calcium carbonate; moderately alkaline (pH 8.0); clear wavy boundary.

Bk2—38 to 55 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly effervescent; few fine filaments, threads, and masses of calcium carbonate; moderately alkaline (pH 8.4); gradual wavy boundary.

C—55 to 60 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; massive; soft friable, slightly sticky and nonplastic; strongly effervescent; calcium carbonate disseminated; strongly alkaline (pH 8.6).

Depth to calcium carbonate accumulations ranges from 10 to 20 inches, but the soils may be slightly effervescent from 0 to 5 inches in some pedons that receive intermittent recharge of calcium carbonate.

The Bt and Btk horizon textures are silty clay loam or clay loam. Reaction is slightly acid or neutral in the Bt horizon.

The Bk horizon texture is loam, silt loam, or silty clay loam. Electrical conductivity ranges from 0 to 2 millimhos per centimeter. Sodium adsorption ratio is 0 to 5.

## Xema Series

The Xema series consists of moderately deep, well drained soils on hills and ridges. The soils formed in eolian deposits or alluvium over residuum derived primarily from sandstone. Slopes range from 3 to 30 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical pedon of Xema fine sandy loam, about 300 feet east and 2,350 feet north of the southwest corner of section 26, T. 55 N., R. 69 W.; USGS topographic quadrangle Brislawn School, WY; 44 degrees 43 minutes 14 seconds north latitude and 105 degrees 7 minutes 28 seconds west longitude

A—0 to 4 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine angular blocky structure parting to weak thin platy; soft, very

friable, nonsticky and nonplastic; many very fine and fine and common medium roots throughout; many fine low continuity vesicular and tubular pores; neutral; clear smooth boundary.

Bt1—4 to 13 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine angular blocky; soft, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; many fine low continuity vesicular and tubular pores; common distinct continuous dark brown (10YR 3/3) clay bridging between sand grains; neutral; clear wavy boundary.

Bt2—13 to 22 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium angular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; many fine low continuity vesicular and tubular pores; few distinct discontinuous dark yellowish brown (10YR 3/4) clay bridging between sand grains; slightly alkaline; clear wavy boundary.

Bk—22 to 31 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium angular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots throughout; common fine low continuity vesicular and tubular pores; slightly effervescent; carbonates are disseminated throughout; moderately alkaline; clear wavy boundary.

Cr—31 to 60 inches; soft calcareous sandstone; slightly effervescent; moderately alkaline.

Depth to bedrock ranges from 20 to 40 inches. Depth to calcium carbonate accumulations ranges from 12 to 40 inches.

The Bt and Bk horizon textures are fine sandy loam or sandy loam. Reaction is neutral to slightly alkaline in the Bt horizon.

## Ziggy Series

The Ziggy series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed sedimentary sources. Slopes range from 0 to 15 percent. Elevation is 4,300 to 4,800 feet. The average annual precipitation is 15 to 17 inches, the

average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Aridic Haplustepts

Typical pedon of Ziggy loam, in an area of Ziggy-lwait loams, 0 to 6 percent slopes, about 350 feet south and 1,300 feet west of the northeast corner of section 28, T. 50 N., R. 74 W.; USGS topographic quadrangle Jeffers Draw, WY; 44 degrees 17 minutes 13 seconds north latitude and 105 degrees 45 minutes 27 seconds west longitude

A—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine platy structure parting to weak fine granular; soft, friable, nonsticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

Bw—5 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; slightly effervescent; calcium carbonate disseminated; slightly alkaline; clear smooth boundary.

Bk1—14 to 32 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; common fine and very fine roots; strongly effervescent; common fine irregularly shaped filaments and masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Bk2—32 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few fine and very fine roots; strongly effervescent; many fine irregularly shaped filaments and common fine rounded masses of calcium carbonate; moderately alkaline.

Depth to calcium carbonate accumulations ranges from 0 to 8 inches.

Reaction in the A horizon is neutral or slightly alkaline.

The Bw and Bk horizon textures are loam or clay loam. Reaction is slightly alkaline or moderately alkaline in the Bw horizon. In the Bk horizon, electrical conductivity ranges from 0 to 2 millimhos per centimeter and the sodium adsorption ratio is 0 to 5.

## Zigweid Series

The Zigweid series consists of very deep, well drained soils on alluvial fans, fan remnants, hills, and ridges. The soils formed in alluvium derived from mixed sources. Slopes range from 0 to 15 percent. Elevation is 4,100 to 5,200 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 45 to 49 degrees F., and the frost-free period is 105 to 130 days.

Taxonomic Class: Fine-loamy, mixed, superactive, mesic Ustic Haplocambids

Typical pedon of Zigweid loam, in an area of Cambria-Kishona-Zigweid loams, 0 to 6 percent slopes, about 400 feet south and 1,200 feet west of the northeast corner of section 17, T. 45 N., R. 73 W.

A—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium and moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly alkaline; clear wavy boundary.

Bw—2 to 13 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; slightly effervescent; calcium carbonate disseminated; moderately alkaline; clear wavy boundary.

Bk1—13 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, firm, sticky and plastic; common fine and very fine roots; strongly effervescent; few fine threads and masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Bk2—23 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; strongly effervescent; few fine threads and masses of calcium carbonate; moderately alkaline.

Depth to accumulations of calcium carbonate ranges from 0 to 8 inches.

The Bw and Bk horizon textures are loam or clay loam. In the Bk horizon, electrical conductivity ranges from 0 to 2 millimhos per centimeter and the sodium adsorption ratio is 0 to 5.



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# Glossary

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**ABC soil.** A soil having an A, a B, and a C horizon.

**AC soil.** A soil having only an A and a C horizon.

Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alkali (sodic) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Alluvial fan.** The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Alpha,alpha-dipyridyl.** A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

**Animal unit month (AUM).** The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

**Aquic conditions.** Current soil wetness characterized by saturation, reduction, and redoximorphic features.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Argillic horizon.** A genetically developed horizon of significant clay accumulation, situated below the surface layer in a soil profile. It is that part of the subsoil referred to as the Bt and, in some profiles, the Btk horizon.

**Aspect.** The direction in which a slope faces.

**Association, soil.** A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Authigenic.** The accumulation of salts in a soil horizon which are derived primarily from the parent material and which formed in place.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low .....	0 to 3.5
Low .....	3.5 to 5.0
Moderate .....	5.0 to 7.5
High .....	more than 7.5

**Backslope.** The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

**Badland.** Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

- Base saturation.** The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.
- Base slope.** A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).
- Bedding planes.** Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.
- Bedding system.** A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Bedrock-controlled topography.** A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.
- Bisequum.** Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.
- Blowout.** A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.
- Bottom land.** The normal flood plain of a stream, subject to flooding.
- Breaks.** The steep and very steep broken land at the border of an upland summit that is dissected by ravines.
- Brush management.** Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.
- Butte.** An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.
- Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.
- Cambic horizon.** A structural horizon below the surface layer which does not have the clay accumulation necessary for an argillic horizon. It is that part of the subsoil referred to as the Bw horizon.
- Canopy.** The leafy crown of trees or shrubs. (See Crown.)
- Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Channery soil material.** Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a chanter.
- Chemical treatment.** Control of unwanted vegetation through the use of chemicals.
- Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay depletions.** Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.
- Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
- Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

- Climax plant community.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.
- Compressible** (in tables). Excessive decrease in volume of soft soil under load.
- Concretions.** Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.
- Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.
- Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.
- Consistence, soil.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."
- Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
- Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 inches.
- Corrosion.** Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.
- Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.
- Cretaceous age.** The period of the Cenozoic Era of geologic time from approximately 100 million to 65 million years ago.
- Cropping system.** Growing crops according to a planned system of rotation and management practices.
- Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.
- Crown.** The upper part of a tree or shrub, including the living branches and their foliage.
- Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.
- Decreasers.** The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.
- Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.
- Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.
- Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**Diversion (or diversion terrace)**. A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained*. These classes are defined in the “Soil Survey Manual.”

**Drainage, surface**. Runoff, or surface flow of water, from an area.

**Draw**. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

**Duff**. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

**Dune**. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

**Eluviation**. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Endosaturation**. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

**Eolian soil material**. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

**Ephemeral stream**. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

**Episaturation**. A type of saturation indicating a perched water table in a soil in which saturated

layers are underlain by one or more unsaturated layers within 2 meters of the surface.

**Erosion**. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

**Escarpment**. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

**Excess fines** (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

**Excess lime** (in tables). Excess carbonates in the soil that restrict the growth of some plants.

**Excess salts** (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

**Excess sodium** (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

**Fallow**. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

**Fan remnant**. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

**Fast intake** (in tables). The rapid movement of water into the soil.

**Fertility, soil**. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Field moisture capacity**. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field*

*capacity, normal moisture capacity, or capillary capacity.*

- Fill slope.** A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.
- Fine textured soil.** Sandy clay, silty clay, or clay.
- Flagstone.** A thin fragment of sandstone, slate or shale 6 to 15 inches (15 to 38 centimeters) long.
- Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.
- Footslope.** The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).
- Forb.** Any herbaceous plant not a grass or a sedge.
- Fragile** (in tables). A soil that is easily damaged by use or disturbance.
- Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.
- Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.
- Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.
- Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
- Gravel.** Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.
- Gravelly soil material.** Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.
- Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.
- Ground water.** Water filling all the unblocked pores of the material below the water table.
- Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.
- Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.
- Head slope.** A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.
- High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.
- Hill.** A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:  
*O horizon.*—An organic layer of fresh and decaying plant residue.  
*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.  
*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.  
*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive

characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon*.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon*.—Soft, consolidated bedrock beneath the soil.

*R layer*.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Impervious soil.** A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

**Increasers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration capacity.** The maximum rate at which water can infiltrate into a soil under a given set of conditions.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Interfluve.** An elevated area between two drainageways that sheds water to those drainageways.

**Intermittent stream.** A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

**Invaders.** On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

**Iron depletions.** Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

**Knoll.** A small, low, rounded hill rising above adjacent landforms.

**Lamellae.** Bands or layers containing translocated clay, which occur at irregular intervals in a soil profile. Coarser material typically occurs between bands. Lamellae constitute an argillic horizon when their cumulative thickness exceeds six inches.

**Large stones** (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Lignite.** Soft, dark brown to black coal which occurs as a powdery material or as fine flakes in some soils and parent materials.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Loess.** Fine grained material, dominantly of silt-sized particles, deposited by wind.

**Low strength.** The soil is not strong enough to support loads.

**Masses.** Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium

carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

- Mechanical treatment.** Use of mechanical equipment for seeding, brush management, and other management practices.
- Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.
- Mesa.** A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.
- Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
- Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.
- Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.
- Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.
- Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.
- Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.
- Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).
- Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.
- Natric horizon.** A special kind of argillic horizon that contains enough exchangeable sodium to have

an adverse effect on the physical condition of the subsoil.

- Neutral soil.** A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)
- Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.
- Nose slope.** A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.
- Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
- Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:
- |                      |                       |
|----------------------|-----------------------|
| Very low .....       | less than 0.5 percent |
| Low .....            | 0.5 to 1.0 percent    |
| Moderately low ..... | 1.0 to 2.0 percent    |
| Moderate .....       | 2.0 to 4.0 percent    |
| High .....           | 4.0 to 8.0 percent    |
| Very high .....      | more than 8.0 percent |
- Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.
- Parent material.** The unconsolidated organic and mineral material in which soil forms.
- Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.
- Pedisediment.** A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.
- Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.
- Percolation.** The movement of water through the soil.
- Percs slowly** (in tables). The slow movement of

water through the soil adversely affects the specified use.

**Permeability.** The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow .....	0.0 to 0.01 inch
Very slow .....	0.01 to 0.06 inch
Slow .....	0.06 to 0.2 inch
Moderately slow .....	0.2 to 0.6 inch
Moderate .....	0.6 inch to 2.0 inches
Moderately rapid .....	2.0 to 6.0 inches
Rapid .....	6.0 to 20 inches
Very rapid .....	more than 20 inches

**Phase, soil.** A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Playa.** The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary or seasonal ponding occurs primarily in response to precipitation and runoff.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor outlets** (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

**Porcelanite.** A hard rock-like material of relatively low specific gravity, formed by the baking and fusing of shale and sandstone adjacent to (commonly overlying) burned-out coal seams. A material which is more resistant to weathering than surrounding Tertiary formations, porcelanite typically forms rounded, rolling to steep hills and conical peaks that occur throughout the eastern half of the survey area. It is resistant to erosion.

**Potential native plant community.** See Climax plant community.

**Potential rooting depth (effective rooting depth).**

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

**Prescribed burning.** Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Proper grazing use.** Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

**Range condition.** The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

**Rangeland.** Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts,

tundras, and areas that support certain forb and shrub communities.

**Range site.** An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid .....	less than 3.5
Extremely acid .....	3.5 to 4.4
Very strongly acid .....	4.5 to 5.0
Strongly acid .....	5.1 to 5.5
Moderately acid .....	5.6 to 6.0
Slightly acid .....	6.1 to 6.5
Neutral .....	6.6 to 7.3
Slightly alkaline .....	7.4 to 7.8
Moderately alkaline .....	7.9 to 8.4
Strongly alkaline .....	8.5 to 9.0
Very strongly alkaline .....	9.1 and higher

**Redoximorphic concentrations.** Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

**Redoximorphic depletions.** Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

**Redoximorphic features.** Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha, alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

**Reduced matrix.** A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

**Ridge.** A long, narrow elevation of land surface, usually sharp crested with steep sides and forming an extended upland between valleys.

**Rill.** A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

**Road cut.** A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

**Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

**Rooting depth (in tables).** Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Saline soil.** A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-sized particles.

**Saturation.** Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

**Sedimentary rock.** Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Sequum**. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

**Series, soil**. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Shale**. Sedimentary rock formed by the hardening of a clay deposit.

**Sheet erosion**. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shoulder**. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

**Shrink-swell** (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Side slope**. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

**Silica**. A combination of silicon and oxygen. The mineral form is called quartz.

**Silt**. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Siltstone**. Sedimentary rock made up of dominantly silt-sized particles.

**Similar soils**. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

**Slickensides**. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**Slickspot**. A small area of soil having a puddled, crusted, or smooth surface and an excess of

exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**Slope**. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Nearly level .....	0 to 3 percent
Gently sloping .....	3 to 6 percent
Moderately sloping .....	6 to 15 percent
Moderately steep .....	15 to 30 percent
Steep .....	30 to 60 percent
Very steep .....	60 percent and higher

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Slow intake** (in tables). The slow movement of water into the soil.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Sodic (alkali) soil**. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Soft bedrock**. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

**Soil**. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates**. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand .....	2.0 to 1.0
Coarse sand .....	1.0 to 0.5

Medium sand .....	0.5 to 0.25
Fine sand .....	0.25 to 0.10
Very fine sand .....	0.10 to 0.05
Silt .....	0.05 to 0.002
Clay .....	less than 0.002

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Summer fallow.** The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

**Summit.** The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

**Surface soil.** The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

**Syncline.** A geologic unit of folded strata that are concave upward.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

**Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Tertiary age.** The period of the Cenozoic Era of geologic time from approximately 65 million to 2 million years ago.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

**Thin layer (in tables).** Otherwise suitable soil material that is too thin for the specified use.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Toeslope.** The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

**Too arid** (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Toxicity** (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

**Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

**Underlying material.** That part of a soil profile below the surface layer when no subsoil is present. Technically, the C horizon in an A-C soil profile.

**Unstable fill** (in tables). Risk of caving or sloughing on banks of fill material.

**Upland.** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Variagation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Windthrow.** The uprooting and tipping over of trees by the wind.