USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with University of Nebraska, Conservation and Survey Division

# Soil Survey of Sioux County, Nebraska

# How to Use This Soil Survey

### General Soil Map

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

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

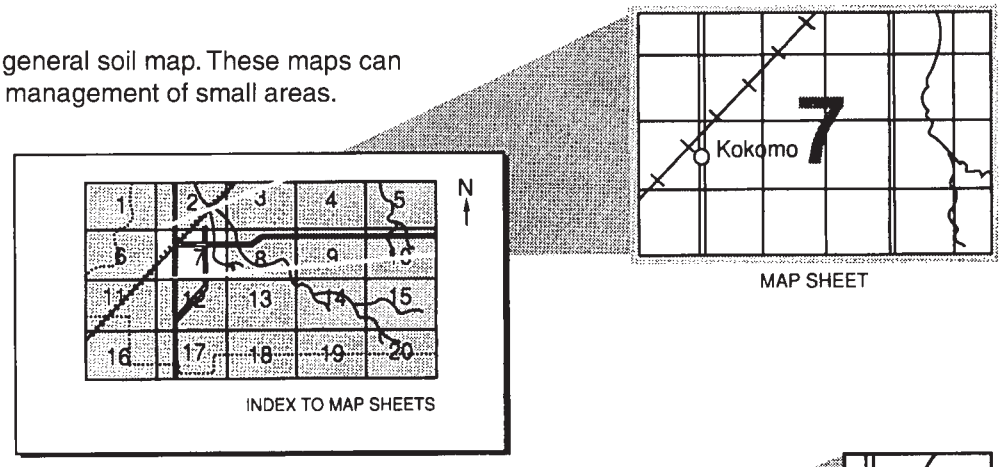
### Detailed Soil Maps

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

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

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

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




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.

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 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the University of Nebraska, Conservation and Survey Division. The survey is part of the technical assistance furnished to the Upper Niobrara-White and North Platte Natural Resources Districts.

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



**Cover: Sugarloaf Butte, which is in the Oglala National Grassland, in the northern part of Sioux County.**

# Contents



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# Foreword

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

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

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

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

Stephen K. Chick
State Conservationist
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# Soil Survey of
# Sioux County, Nebraska

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
University of Nebraska, Conservation and Survey Division

Sioux County is in the northwest corner of the Panhandle in western Nebraska (fig. 1). It is 28 to 33 miles wide from east to west and 69 miles long from north to south. It has an area of 1,324,876 acres. Harrison is the county seat.

Most of the residents of the county work in agriculture-related jobs or earn their living by farming or ranching. Farming and ranching are the main economic enterprises. Ranching is the main source of income in the county. Ranches are large and for the most part are owned by the operator. Some ranches or areas of grazing land are leased from owners who live outside the county or have retired. The U.S. Forest Service administers grazing permits on 94,344 acres, which includes the Oglala National Grassland and the Soldier Creek National Wilderness area.

The raising of livestock, mainly cow and calf herds, is the largest industry in the county. Corn, sugar beets, dry edible beans, and alfalfa are the main irrigated crops. Winter wheat and hay are the main dryland crops. A scarcity of seasonal rainfall limits dryland crop production in normal years.

Approximately 90 percent of the total land area in the county supports native grasses, which are used for grazing or hay. The soils in the northern part of the county, below the Pine Ridge, formed material weathered from shale and siltstone. They are suited mainly to rangeland. A few areas are used for hay or wheat. Water erosion and soil blowing are the main hazards.

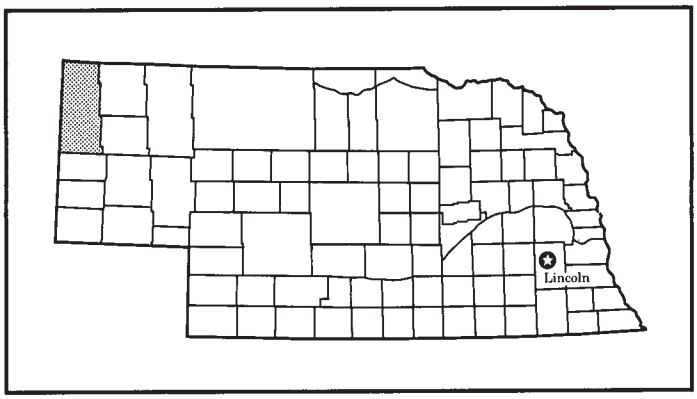


**Figure 1.—Location of Sioux County in Nebraska.**

The major soils on the Pine Ridge and on the breaks along the Niobrara River formed in material weathered from sandstone. They are loamy and sandy soils that are best suited to rangeland. They are generally too shallow and too steep for cultivation.

The soils in the sandhills and on dunes in the river valleys formed in sandy eolian material. They are suited to rangeland. Soil blowing is the main hazard.

Deep, well drained, loamy and silty soils are on valley foot slopes, uplands, and stream terraces. The more gently sloping soils are suited to cultivation. The steeper soils are better suited to rangeland. Water erosion and soil blowing are the main hazards.

Sandy, silty, and loamy soils are on the stream terrace along the North Platte River, in the southwest corner of the county. The silty and loamy soils produce good yields of the commonly grown local crops. The very gently sloping and nearly level, loamy and silty soils are suited to irrigated and dryland crops. The sandy soils are best suited to rangeland. Soil blowing and water erosion are hazards.

Some of the soils in the county formed in alluvium on flood plains. These soils are clayey, loamy, or sandy. In most areas they are best suited to rangeland and hay. In a few areas they are suited to dryland or irrigated crops. The wetness caused by a seasonal high water table is a limitation. Some of the soils are affected by saline-alkali characteristics. Flooding and soil blowing are the main hazards.

This soil survey updates the survey of Sioux County published in 1922 *(5)*. It provides more detailed information about the soils and has larger maps, which show the soils in greater detail.

## General Nature of the County

This section provides general information about Sioux County. It describes history and development, climate, geology, water supply, physiography and drainage, and trends in agriculture.

### History and Development

In the 1830's, the first fur traders and trappers entered the survey area, which at that time was inhabited by Sioux, Cheyenne, and Arapahoe Indians *(9)*. Cattle ranches were established in the late 1870's. Fort Robinson, which is in both Sioux and Dawes Counties, was established in 1874. It played an important role in the settlement of the western areas of Nebraska and South Dakota. The first homesteader came to the county in 1880. The county was established in 1885. The first railroad in the county was the Fremont, Elkhorn, and Missouri Valley (now the Chicago and Northwestern), which crossed the northern part of the county in 1886. Harrison, originally a construction camp along the railroad, also was established in 1886.

Because of Indian wars, large-scale settlement of the county was delayed until the 1890's. Settlement rapidly increased after passage of the Kincaid Act of 1904, which gave each homesteader 640 acres of land. Drought, which hit in 1910 and lasted for several years, significantly reduced the population of the county. Since those years of drought, the population has declined steadily. It has declined less in the southwestern part of the county than in other parts. Irrigation with water from the North Platte River began in the 1890's in the southwestern part, which remains the most densely populated part of the county. The population of the county was 5,599 in 1910; 4,528 in 1920; and 1,549 in 1990. In 1990, the population of Harrison was 291 and the population of Glen, which is unincorporated, was 6.

### Climate

Sioux County is usually warm in summer, when it is frequently subject to hot winds. In winter, periods of very cold weather are caused by Arctic air moving in from the north or northwest. Cold periods alternate with milder periods, which often occur when westerly winds are warmed as they move downslope. Precipitation generally falls as rain during the warmer part of the year. It is normally heaviest in late spring and early summer. Winter snowfalls are frequent, but the snow cover usually disappears during mild periods.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Harrison in the period 1951 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 24 degrees F and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Harrison on January, 19, 1963, is -33 degrees. In summer, the average temperature is 67 degrees and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred at Harrison on July 12, 1954, is 105 degrees.

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

The total annual precipitation is about 17.3 inches. Of this, about 13 inches, or more than 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 10 inches. The heaviest 1-day rainfall during the period of record was 3.87 inches at Harrison on June 12, 1970. Thunderstorms occur on about 44 days each year. Hailstorms sometimes occur during the warmer part of the year in irregular patterns and in relatively small areas. They cause severe damage to the crops in these areas. Tornadoes and severe thunderstorms strike occasionally. These storms are local in extent and of short duration and result in sparse damage in narrow belts.

The average seasonal snowfall is about 62 inches. The greatest snow depth at any one time during the period of

record was 24 inches. On the average, 44 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. During some winters a heavy blizzard with high winds and drifting snow strikes the survey area. The snow remains on the ground for many weeks after the blizzard.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

## Geology

Prepared by Jim Swinehart, University of Nebraska, Conservation and Survey Division.

The majority of the strata exposed in Sioux County are part of an extensive sequence of Tertiary-age (37 to 5 million years old) nonmarine deposits extending eastward from the Hartville and Laramie uplifts in Wyoming. The oldest exposed rocks in the county consist of Late Cretaceous Pierre Shale, which is 70 to 80 million years old. These rocks make up the bedrock in northernmost part of the county. They were deposited in the extensive sea that covered much of the interior of North America during the Cretaceous Period.

The contact between the Pierre Shale and the overlying Tertiary-age Chadron Formation of the White River Group represents more than 40 million years during which uplift, erosion, and intensive weathering occurred in what is now Sioux County. The Chadron Formation, which is Oligocene in age (37 to 33 million years old), is as much as 200 feet thick in the subsurface. It consists of sandstone with local conglomerates and siltstone deposited in an ancient valley that extends eastward across northern Sioux County.

In other parts of the county, the Chadron Formation is exposed only along the foot of the Pine Ridge and consists of bentonitic, greenish gray and gray claystones and mudstones. The Brule Formation, which also is Oligocene in age (33 to 29 million years old), overlies the Chadron Formation. It consists of brown to greenish gray mudstones and siltstones as much as 800 feet thick. It is exposed all along the Pine Ridge, along the valley of the North Platte River in southwest Sioux County, and along the Niobrara River in the east-central part of the county. The Arikaree Group, which is Late Oligocene to Early Miocene in age (28 to 19 million years old), overlies the Brule Formation throughout the central part of the county. This group generally can be divided into three units with a combined thickness of about 800 feet: gray to brownish, fine grained or medium grained sandstones and siltstones with local fine gravel of the Gering Formation; gray, silty, very fine grained sandstones with carbonate-cemented horizons of the Monroe Creek and Harrison Formations; and brown, sandy siltstones of the Upper Harrison beds. Both the Arikaree and White River Groups have large amounts of volcanically derived detritus, primarily volcanic glass shards, in addition to discrete beds of volcanic ash.

The Ogallala Group, which is Middle to Late Miocene in age (about 18 to 5 million years old), is exposed in the valley of the Niobrara River in east-central Sioux County and occurs as isolated patches in the southern part of the county. This group has been divided into at least five formations in Sioux County, but the bulk of the exposures belong to the oldest Ogallala unit, the Runningwater Formation. Like the rest of the Ogallala Group, this formation is generally coarser grained and more heterogeneous than the older Tertiary units. The Ogallala rocks are a complex set of ancient valley fills composed mostly of material derived from the mountains to the west, although discrete beds of volcanic ash are evident.

Isolated alluvial deposits of Pliocene and Quaternary age are in the southwest corner of the county and along the major streams. Sand dunes cover part of south-central Sioux County. They are probably less than 5,000 years old.

Sioux County is one of the few areas in Nebraska where faults have been recognized and mapped at the surface. It is not known whether any of these faults are currently active. Western Nebraska has undergone significant regional uplift in the last 5 million years. During this period erosion has greatly exceeded deposition and has been the major factor influencing the evolution of the landscape in Sioux County.

## Water Supply

Ground-water supplies in Sioux County vary in both quantity and quality. The Pierre Shale north of the Pine Ridge is not considered to be an aquifer. The lack of ground water has resulted in the construction of a large network of pipelines that carry water from the Pine Ridge to areas throughout northern Sioux County. The water for these pipelines comes from the Arikaree Group and from fractured areas in the Brule Formation. Wells yielding as much as 100 gallons per minute have been developed in the Brule Formation *(4)*. The Arikaree Group around Harrison has the potential to yield several hundred gallons of water per minute.

South of the Pine Ridge, the major source of ground water is the Arikaree Group, which is a complex series of sandy siltstones and silty sandstones. The saturated thickness of the Arikaree Group is greatest in areas around Harrison because of a paleovalley in the Arikaree Group in these areas. The saturated thickness of the Arikaree Group decreases to the south. In Sioux County

this group is used primarily as a source of domestic and livestock water. The water from the Arikaree Group generally has total dissolved solids of less than 500 parts per million.

Irrigation wells have been developed in the valley of the Niobrara River in central Sioux County. In the western part of the county, the wells are in sandy alluvium and the underlying Arikaree Group and yields can be as high as 750 gallons per minute. In the eastern end of the county, wells in the valley of the Niobrara River can penetrate into the Brule Formation. Irrigation wells also have been developed in the Dutch Flats area in southwestern Sioux County. This area is a terrace along the North Platte River, and high-yielding irrigation wells have been developed in the alluvial sand and gravel in the area *(3)*. There has been scattered irrigation development in a small area of the Oglala Formation in southeastern Sioux County.

Surface water is used for irrigation in several different parts of Sioux County. Water is carried from the North Platte River to the Dutch Flats area in southwestern Sioux County via the Interstate Canal. Several small canals are used to divert water from the Niobrara River for flood-irrigation purposes.

Many small streams emanate from the base of the Pine Ridge in the northern part of the county. Water is taken from many of these streams and used for flood-irrigation of hay meadows.

## Physiography and Drainage

Sioux County is in the High Plains section of the Great Plains physiographic province. Seven general types of landforms make up the county—a shale plain and badlands; steep hills and escarpments; a mixed sandy and silty, eroded tableland; sandhills; stream valleys; a large stream terrace; and foot slopes.

The broad, rolling shale plains and the badlands dominate the north end of the county, below the Pine Ridge. They are made up largely of material weathered from Cretaceous- and Tertiary-age shales and siltstones. Slopes range from nearly level to very steep. Permeability in the soils of this area is restricted. As a result, much of the seasonal precipitation runs off the surface. The area is dissected by many entrenched drainageways and badlands. The streams that drain the area include Antelope Creek, Indian Creek, Whitehead Creek, Squaw Creek, Jim Creek, Warbonnet Creek, Monroe Creek, Prairie Dog Creek, Big and Little Cottonwood Creeks, and Hat Creek. This area makes up 18 percent of the county.

Areas of foot slopes are below the Pine Ridge and above the North Platte terrace. The soils in these areas formed in colluvial material derived from Tertiary sandstone. The foot slopes are characterized by mainly long, smooth slopes dissected by drainageways. These areas make up about 3 percent of the county.

The Pine Ridge is an area of steep, tree-covered hills and escarpments. It extends across the county from northwest to southeast. It is characterized by high relief, extremely rough terrain, and sheer rock outcrops (fig. 2). Tertiary sandstone in this area is the source of many of the streams that flow north and east through the shale plains and badlands. The difference in elevation from the top of the Pine Ridge to the foot slopes below is as much as 600 feet.

In the central part of the county, rugged escarpments, hills, and steep side slopes formed through the deep entrenchment of the Niobrara River and its tributaries. These areas are made up largely of eroded material derived from Tertiary sandstone. Sandstone crops out in many places. The bottom land along the Niobrara River is 100 to 200 feet below the higher hills and escarpments. These areas make up about 14 percent of the county.

A mixed sandy and silty, eroded tableland dominates the county from the Pine Ridge south to the North Platte terrace. It consists of eroded remnants of the ancient high plains. On the steeper slopes, the underlying Tertiary sandstone bedrock is commonly at or near the surface. In a few isolated areas, the bedrock is mantled by silty, loesslike material. Slopes range from nearly level to steep. This part of the county is drained by tributaries of the White River, the Niobrara River, the north and south branches of Snake Creek, Winter Creek, Spotted Tail Creek, Dry Spotted Tail Creek, Sheep Creek, Dry Sheep Creek, and Whistle Creek. This area makes up about 48 percent of the county.

The west-central part of the county and the southeast corner have areas of rolling and hilly sand dunes. The tops of the higher dunes are 50 to 200 feet above the valley floor. This area lacks surface drainage because of highly permeable soils. It makes up about 11 percent of the county.

About 3 percent of the county is in stream valleys. The principal valleys are those of the Niobrara River, the White River, Indian Creek, Hat Creek, Whistle Creek, and Sheep Creek. Indian Creek and Hat Creek are intermittent streams that flow only in the spring and after periods of heavy summer precipitation. The Niobrara River, the White River, Whistle Creek, and Sheep Creek are perennial streams.

In the southwest corner of the county, there is a stream terrace that was formed by the North Platte River. This terrace is mainly level or very gently sloping. It includes most of the irrigated farmland in Sioux County. The soils in the area formed in old alluvial sediments. The area is drained by Spotted Tail Creek, Dry Spotted Tail Creek, Sheep Creek, and Dry Sheep Creek. It makes up 3 percent of the county.

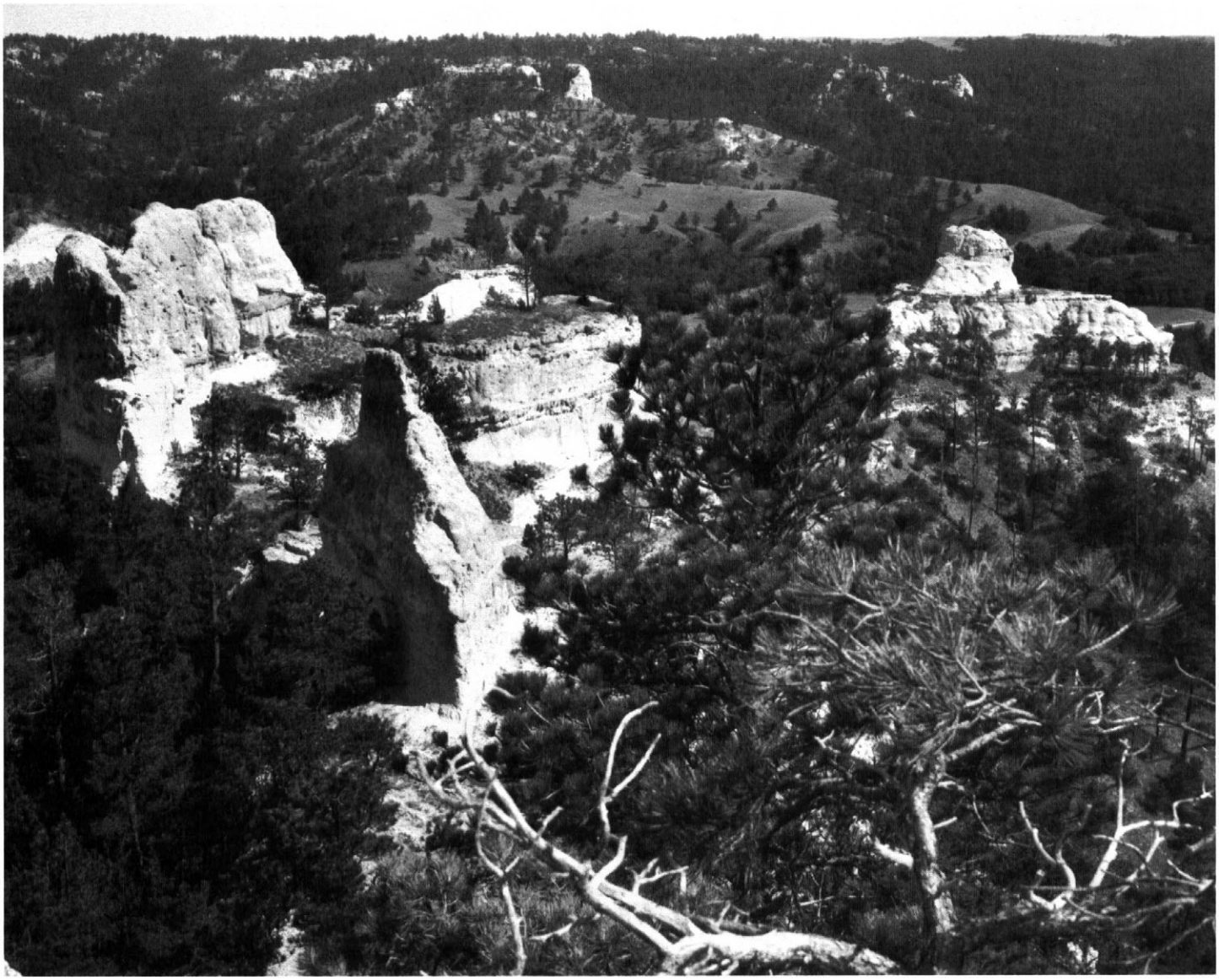

**Figure 2.—The Pine Ridge area in Sioux County. Castle Butte, which is in Sowbelly Canyon north of Harrison, is in the center of the picture.**

Sioux County has an average elevation of 4,500 feet above sea level. The elevation ranges from 5,255 feet in an area near the State line northwest of Harrison to 3,560 feet in an area where Hat Creek enters South Dakota. The Niobrara River enters the county at an elevation of 4,740 feet and leaves at an elevation of 4,320 feet. Harrison is at an elevation of 4,874 feet.

## Trends in Agriculture

Ranching and farming have been the most important enterprises in Sioux County since the county was settled. The trend is towards fewer and larger ranches and farms. The number of farms and ranches was 375 in 1980. By 1985, the number had decreased to 350. The ranches, where farming generally is limited to haying, range from 2,500 to 45,000 acres in size. The farms used mostly for dryland crops range from 640 to 6,500 acres in size, and those used mostly for irrigated crops range from 200 to 1,000 acres. Some farmers in the southwest corner of the county supplement their income with off-the-farm employment.

Most of the farmland is in the southwest corner of the county, where the Interstate Canal is a dependable source of irrigation water for 27,000 acres. As of 1985, there were 211 registered irrigation wells that irrigate an additional 20,000 acres in various locations throughout the county.

The irrigated crops grown in the county include corn,

alfalfa, sugar beets, dry edible beans, and winter wheat. The general trend in the county is to seed dry cropland back to grasses used for grazing.

The raising of livestock, mainly cattle, is the main source of income for most operators in the county. The number of cattle remained fairly constant from 1960 to 1985. The number of cattle on feed increased from 7,800 in 1975 to 9,500 in 1985.

## How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; 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 in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

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-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. 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 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 assure 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.

### Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural

objects, they have a characteristic variability in their properties. 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 soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns 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 (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

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

# General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association 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 or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, variations in slope groupings, and application of the latest classification system.

## Badland and Well Drained, Clayey and Loamy Soils on Hillslopes and Stream Terraces

The soils in this group formed in material weathered from shale. They are used mainly as rangeland.

## 1. Pierre-Samsil Association

*Moderately deep and shallow, very gently sloping to very steep, well drained, clayey soils on hillslopes*

### *Setting*

*Landform:* Hillslopes
*Slope range:* 1 to 50 percent

### *Composition*

*Extent of the association in the county:* 9 percent

*Extent of components in the association:*
Pierre soils—45 percent
Samsil soils—21 percent
Minor soils—34 percent

### *Soil Properties and Qualities*

**Pierre**

*Depth class:* Moderately deep
*Depth to paralithic contact:* 20 to 40 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes
*Parent material:* Residuum weathered from shale
*Texture of the surface layer:* Clay
*Slope:* 1 to 30 percent

**Samsil**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from shale
*Texture of the surface layer:* Clay
*Slope:* 3 to 50 percent

### *Minor Soils*

- Kyle soils, which are deep and are on broad divides and stream terraces
- Bufton soils, which are very deep and are on hillslopes
- Arvada and Hisle soils and Slickspots, which are high in content of sodium and are on hillslopes and stream terraces
- Olney soils, which are very deep, formed in mixed eolian sediments, and are on hillslopes

### *Use and Managment*

*Major uses:*
- Most of the acreage supports native grasses used for grazing. A small acreage is cultivated.

*Management concerns:*
- Soil blowing and water erosion in cultivated areas
- Proper range management

- Insufficient rainfall during the growing season
- Droughtiness during dry years because the subsoil absorbs moisture slowly and releases it slowly to plants

*Management measures:*

- Controlling water erosion and soil blowing and improving fertility on cropland and hayland
- Proper grazing use through a planned grazing system

## 2. Bufton-Orella-Badland Association

*Badland and very deep and shallow, nearly level to very steep, well drained, clayey and loamy soils on hillslopes and stream terraces*

### Setting

*Landform:* Hillslopes and stream terraces (fig. 3)
*Slope range:* 0 to 50 percent

### Composition

*Extent of the association in the county:* 4 percent
*Extent of components in the association:*
Bufton soils—61 percent
Orella soils—16 percent
Badland—14 percent
Minor soils—9 percent

### Soil Properties and Qualities

**Bufton**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes and stream terraces
*Parent material:* Residuum weathered from shale
*Texture of the surface layer:* Clay loam
*Slope:* 0 to 20 percent

**Orella**

*Depth class:* Shallow
*Depth to paralithic contact:* 10 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Parent material:* Residuum weathered from shale
*Texture of the surface layer:* Clay
*Slope:* 1 to 30 percent
*Distinctive property:* A high content of sodium

**Badland**

*Landform:* Hillslopes
*Parent material:* Shale and siltstone
*Slope:* 3 to 50 percent
*Distinctive properties:* Barren, highly erosive areas of shale, sandstone, or siltstone

### Minor Soils

- Norrest soils, which are moderately deep and are on hillslopes and divides
- Interior soils, which are on flood plains and are high in content of sodium and other salts
- Craft soils, which are on flood plains and are highly stratified

### Use and Management

*Major uses:*

- Most of the acreage supports native grasses used for grazing. A small acreage is cultivated.

*Management concerns:*

- Insufficient rainfall during the growing season
- Soil blowing and water erosion in cultivated areas
- Proper range management

*Management measures:*

- Controlling water erosion and soil blowing and conserving soil moisture on cropland
- Proper grazing use through a planned grazing system

## Rock Outcrop and Well Drained, Silty, Loamy, and Sandy Soils on Hillslopes and Alluvial Fans

The soils in this group formed in material weathered from siltstone and calcareous sandstone. They are used as cropland and rangeland.

## 3. Thirtynine-Mitchell-Epping Association

*Very deep and shallow, nearly level to very steep, well drained, silty and loamy soils on hillslopes and alluvial fans*

### Setting

*Landform:* Hillslopes and alluvial fans
*Slope range:* 0 to 50 percent

### Composition

*Extent of the association in the county:* 4 percent
*Extent of components in the association:*
Thirtynine soils—33 percent
Mitchell soils—19 percent
Epping soils—14 percent
Minor soils—34 percent

### Soil Properties and Qualities

**Thirtynine**

*Depth class:* Very deep
*Drainage class:* Well drained

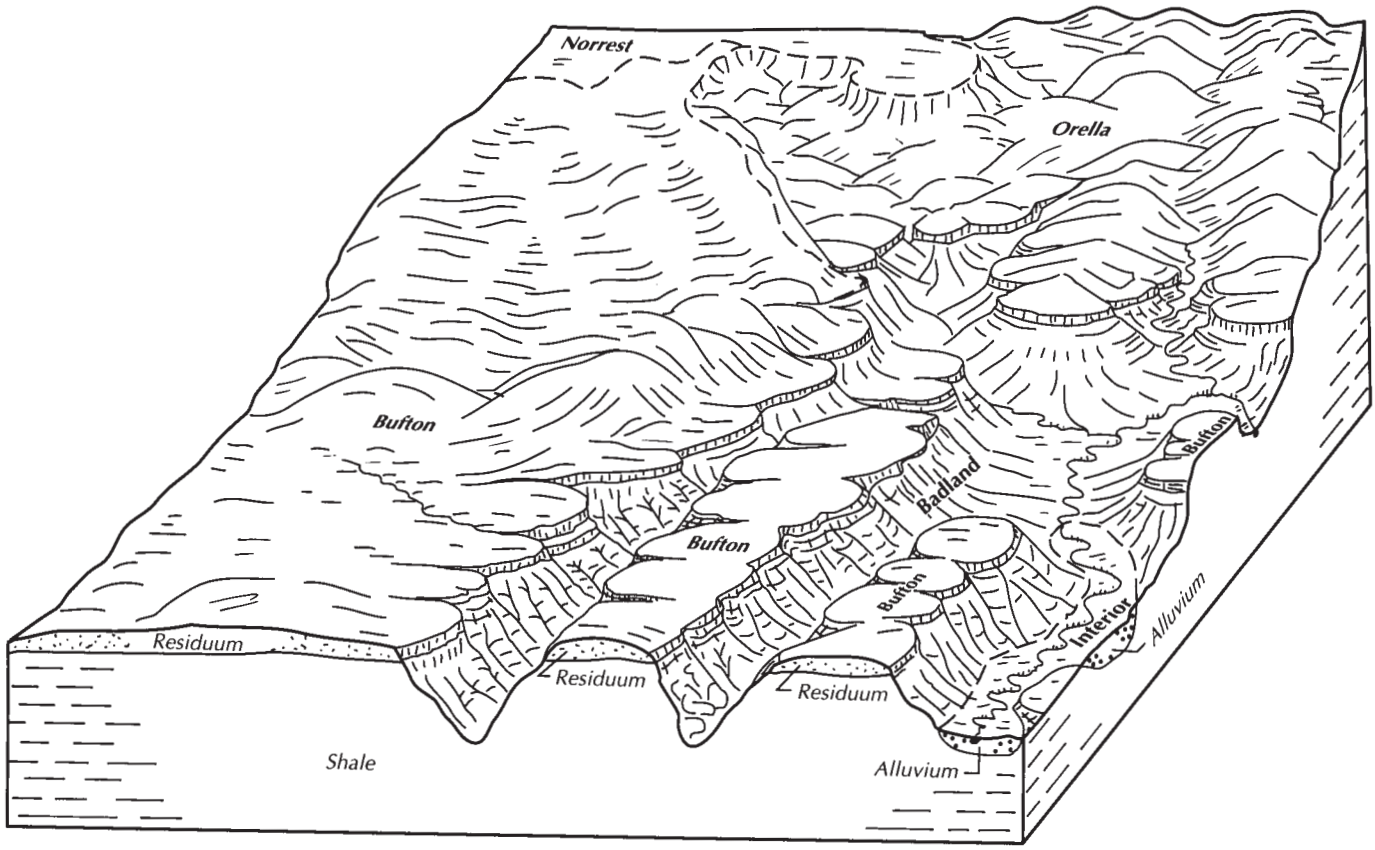


**Figure 3.—Typical pattern of soils and parent material in the Bufton-Orella-Badland association.**

*Landform:* Hillslopes
*Position on the landform:* Summits and back slopes
*Parent material:* Loamy sediments weathered from calcareous siltstone
*Texture of the surface layer:* Loam
*Slope:* 1 to 9 percent

**Mitchell**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes and alluvial fans
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Texture of the surface layer:* Silt loam
*Slope:* 0 to 20 percent

**Epping**

*Depth class:* Shallow
*Depth to paralithic contact:* 10 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous siltstone
*Texture of the surface layer:* Silt loam
*Slope:* 3 to 50 percent

### *Minor Soils*

- Badland, which is at the head of drainageways on hillslopes
- Bufton soils, which are on stream terraces
- Vetal soils, which are on foot slopes and stream terraces
- Glenberg, Interior, and Craft soils, which are on flood plains

### *Use and Management*

*Major uses:*
- Much of the acreage supports native grasses used for grazing or hay. About 20 percent of the acreage is used for cultivated crops.

*Management concerns:*
- Insufficient rainfall during the growing season
- Water erosion and soil blowing in cultivated areas
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system
- Timely deferment of grazing or haying
- Conservation tillage and cover crops, which help to

control soil blowing and water erosion and conserve soil moisture
• Maintaining or improving the organic matter content, fertility, and tilth

## 4. Oglala-Canyon Association

*Deep and shallow, very gently sloping to steep, well drained, loamy soils on hillslopes*

### Setting

*Landform:* Hillslopes
*Slope range:* 1 to 30 percent

### Composition

*Extent of the association in the county:* 12 percent
*Extent of components in the association:*
Oglala soils—45 percent
Canyon soils—19 percent
Minor soils—36 percent

### Soil Properties and Qualities

**Oglala**

*Depth class:* Deep
*Depth to paralithic contact:* 40 to 60 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 1 to 30 percent

**Canyon**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 3 to 30 percent

### Minor Soils

• Satanta soils, which formed in mixed eolian material and are on hillslopes and divides
• Alliance soils, which formed in loamy loess over calcareous sandstone and are on divides and hillslopes
• Vetal soils, which formed in loamy and sandy sediments and are in swales and on foot slopes
• Busher soils, which formed in residuum weathered from sandstone and are on hillslopes
• Jayem soils, which formed in loamy and sandy eolian material and are on hillslopes and divides

### Use and Management

*Major uses:*
• About 75 percent of the acreage supports native grasses used for grazing or hay. The rest is used for cultivated crops.
*Management concerns:*
• Insufficient rainfall during the growing season
• Soil blowing and water erosion in cultivated areas
• Proper range management
*Management measures:*
• Proper grazing use through a planned grazing system
• Timely deferment of grazing or haying
• Conservation tillage and cover crops, which help to control soil blowing and water erosion and conserve soil moisture
• Maintaining or improving the organic matter content, fertility, and tilth

## 5. Busher-Tassel-Jayem Association

*Very deep, deep, and shallow, nearly level to steep, well drained, sandy soils on hillslopes*

### Setting

*Landform:* Hillslopes (fig. 4)
*Slope range:* 0 to 30 percent

### Composition

*Extent of the association in the county:* 24 percent
*Extent of components in the association:*
Busher soils—37 percent
Tassel soils—23 percent
Jayem soils—16 percent
Minor soils—24 percent

### Soil Properties and Qualities

**Busher**

*Depth class:* Deep
*Depth to paralithic contact:* 40 to 60 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 0 to 20 percent

**Tassel**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches

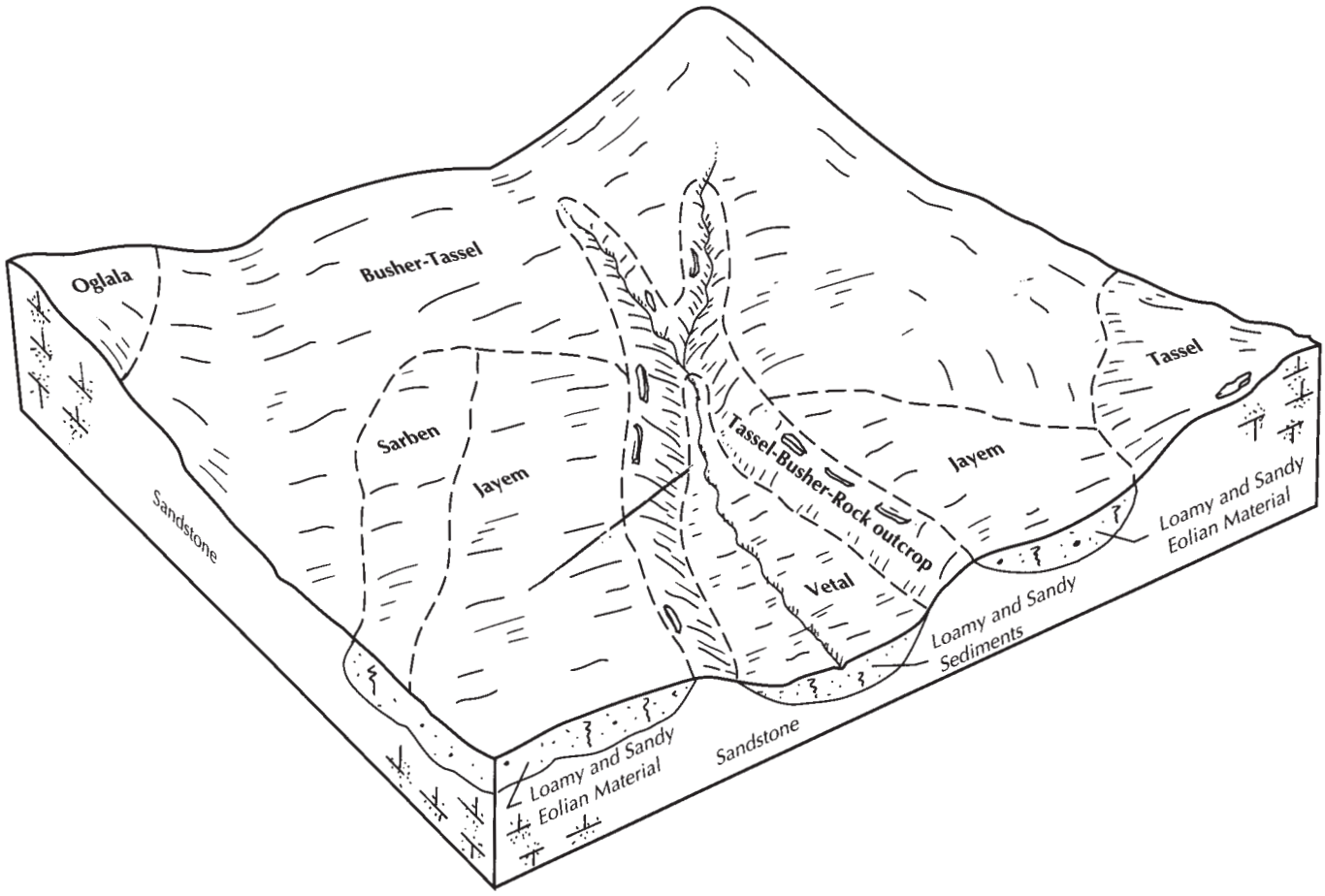


**Figure 4.—Typical pattern of soils and parent material in the Busher-Tassel-Jayem association.**

*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 3 to 30 percent

**Jayem**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Loamy and sandy eolian material
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 0 to 9 percent

### *Minor Soils*

- Sarben soils, which do not have a dark surface soil and are on landscapes similar to those of the Jayem soils
- Valent soils, which are sandy and are on dunes
- Vetal soils, which have a dark surface soil more than 20 inches thick and are on stream terraces
- Oglala soils, which have less sand than the Busher soils and are on similar landscapes
- Rock outcrop, which consists of barren exposures of calcareous sandstone and is on buttes, narrow ridges, and the shoulders of hillslopes

### *Use and Management*

*Major uses:*
- Most of the acreage supports native grasses used for grazing or hay. The rest is used as cropland.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range management
- Soil blowing and water erosion in cultivated areas

*Management measures:*
- Proper grazing use through a planned grazing system
- Timely deferment of grazing or haying

## 6. Tassel-Busher-Rock Outcrop Association

*Rock outcrop and shallow and deep, nearly level to very steep, well drained, sandy soils on hillslopes*

### *Setting*

*Landform:* Hillslopes (fig. 5)
*Slope range:* 0 to 70 percent

### *Composition*

*Extent of the association in the county:* 2 percent
*Extent of components in the association:*
Tassel soils—33 percent
Busher soils—30 percent
Rock outcrop—14 percent
Minor soils—23 percent

### *Soil Properties and Qualities*

**Tassel**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 3 to 70 percent

**Busher**

*Depth class:* Deep
*Depth to paralithic contact:* 40 to 60 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 0 to 20 percent

**Rock outcrop**

*Landform:* Hillslopes
*Position on the landform:* Shoulders and summits
*Kind of rock:* Calcareous sandstone
*Slope:* 9 to 70 percent

### *Minor Soils*

- Jayem and Sarben soils, which do not have bedrock within a depth of 60 inches and are on landscapes similar to those of the Busher soils
- Oglala soils, which are finer textured than the major soils and are lower on the landscape
- Vetal soils, which have a dark surface soil more than 20 inches thick and are in swales and on foot slopes

### *Use and Management*

*Major uses:*
- Most of the acreage supports native grasses used for grazing or hay. The rest is used for cultivated crops.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range management
- Soil blowing and water erosion on cultivated cropland

*Management measures:*
- Proper grazing use through a planned grazing system
- Timely deferment of grazing or haying

## Rock Outcrop and Well Drained, Loamy and Sandy Soils on Hillslopes and Stream Terraces in the Pine Ridge

The soils in this group formed in material weathered from calcareous sandstone. They are used as forest, rangeland, and cropland.

## 7. Tassel-Ponderosa-Rock Outcrop Association

*Rock outcrop and shallow and very deep, moderately steep to very steep, well drained, sandy soils in the Pine Ridge*

### *Setting*

*Landform:* Hillslopes (fig. 6)
*Slope range:* 9 to 70 percent

### *Composition*

*Extent of the association in the county:* 8 percent
*Extent of components in the association:*
Tassel soils—43 percent
Ponderosa soils—23 percent
Rock outcrop—16 percent
Minor soils—18 percent

### *Soil Properties and Qualities*

**Tassel**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 9 to 70 percent

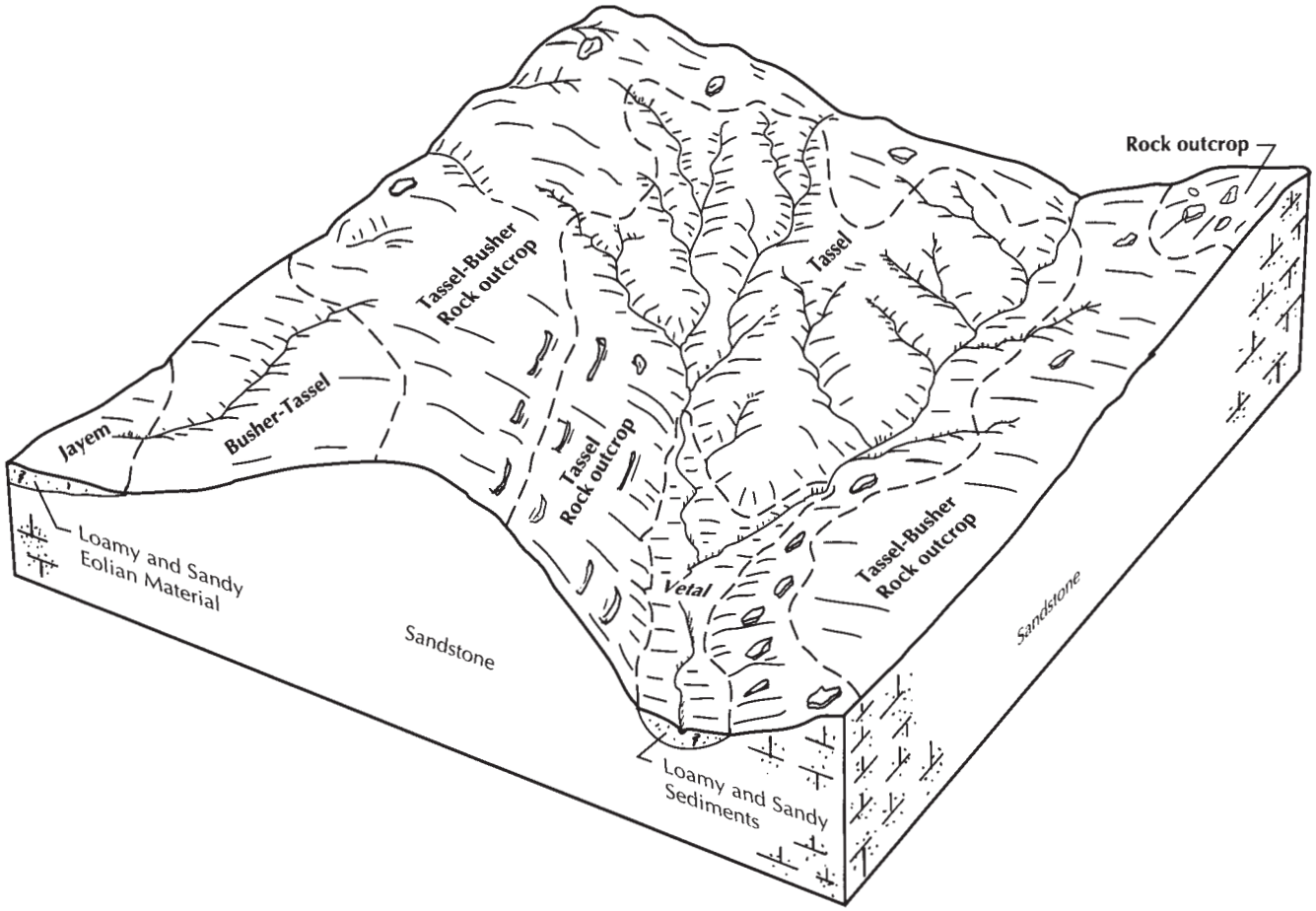


**Figure 5.—Typical pattern of soils and parent material in the Tassel-Busher-Rock outcrop association.**

**Ponderosa**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes, foot slopes, and toe slopes
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 9 to 60 percent

**Rock outcrop**

*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Kind of rock:* Calcareous sandstone
*Slope:* 9 to 70 percent

### *Minor Soils*

- Oglala soils, which are finer textured than the Ponderosa soils and are on similar landscapes
- Canyon soils, which contain more silt and clay than the Tassel soils and are on similar landscapes
- Vetal soils, which are finer textured than the major soils and are on hillslopes and stream terraces
- Jayem soils, which do not have bedrock within a depth of 60 inches and are on hillslopes
- Glenberg soils, which are stratified and are on flood plains

### *Use and Management*

*Major uses:*
- Most areas support native grasses and ponderosa pine and are used for grazing. Some areas have a thick stand of ponderosa pine suitable for timber production. Recreation also is a major use.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range and timber management

*Management measures:*
- Proper grazing use through a planned grazing system

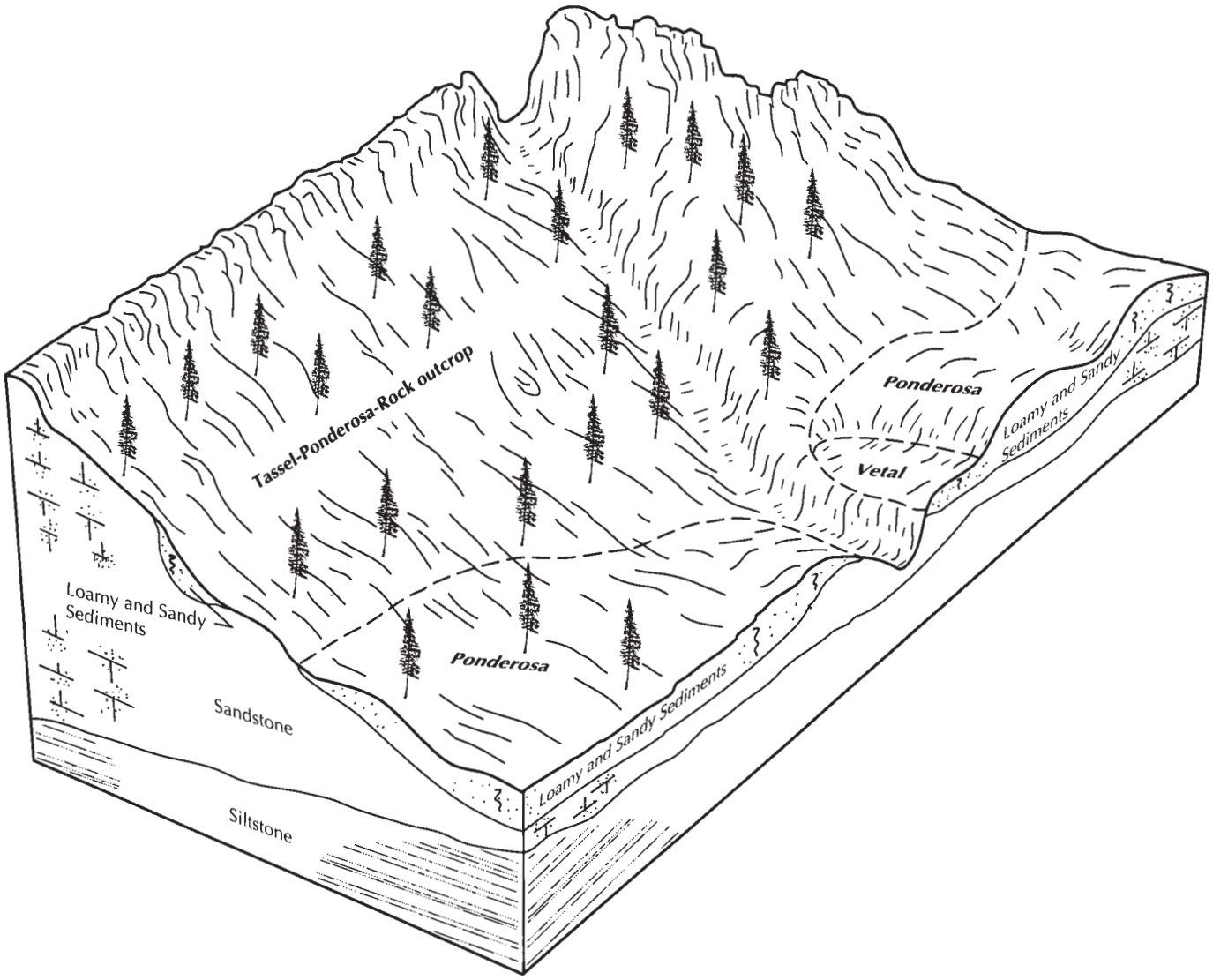


**Figure 6.—Typical pattern of soils and parent material in the Tassel-Ponderosa-Rock outcrop association.**

- Timber management that includes thinning and stand improvement

## 8. Ponderosa-Bridget-Vetal Association

*Very deep, nearly level to steep, well drained, loamy and sandy soils in the Pine Ridge*

### *Setting*

*Landform:* Hillslopes
*Slope range:* 0 to 30 percent

### *Composition*

*Extent of the association in the county:* 3 percent
*Extent of components in the association:*
Ponderosa soils—43 percent
Bridget soils—19 percent
Vetal soils—12 percent
Minor soils—26 percent

### *Soil Properties and Qualities*

**Ponderosa**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes, foot slopes, and toe slopes
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 6 to 30 percent

**Bridget**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Foot slopes
*Parent material:* Loamy colluvial and alluvial sediments
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 3 to 30 percent

**Vetal**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes and stream terraces
*Position on the landform:* Foot slopes
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 0 to 6 percent

### *Minor Soils*

- Tassel soils, which are shallow over bedrock and are on summits and shoulders
- Glenberg soils, which are stratified and are on flood plains
- Jayem and Sarben soils, which formed in sandy and loamy eolian material and are on hillslopes
- Epping soils, which are shallow over siltstone and are on summits and shoulders

### *Use and Management*

*Major uses:*
- Most of the acreage supports native grasses used for grazing. The rest is used as cropland.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range management
- Soil blowing and water erosion in cultivated areas

*Management measures:*
- Proper grazing use through a planned grazing system
- Timely deferment of grazing or haying
- Conservation tillage, terraces, and cover crops, which help to control soil blowing and water erosion and conserve soil moisture
- Maintaining or improving the organic matter content, fertility, and tilth

## Rock Outcrop and Excessively Drained and Well Drained, Loamy and Sandy Soils on Hillslopes, Alluvial Fans, and Stream Terraces

The soils in this group formed in material weathered from calcareous sandstone and in material underlain by gravelly sand. They are used as rangeland.

## 9. Tassel-Ashollow-Rock Outcrop Association

*Rock outcrop and shallow and very deep, gently sloping to very steep, well drained, sandy soils on hillslopes*

### *Setting*

*Landform:* Hillslopes
*Slope range:* 3 to 60 percent

### *Composition*

*Extent of the association in the county:* 9 percent
*Extent of components in the association:*
Tassel soils—40 percent
Ashollow soils—32 percent
Rock outcrop—17 percent
Minor soils—11 percent

### *Soil Properties and Qualities*

**Tassel**

*Depth class:* Shallow
*Depth to paralithic contact:* 6 to 20 inches
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 9 to 60 percent

**Ashollow**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand

*Slope:* 3 to 35 percent

**Rock outcrop**

*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Kind of rock:* Calcareous sandstone
*Slope:* 9 to 60 percent

### *Minor Soils*

- Busher soils, which are finer textured than the major soils and are on hillsides
- Valent soils, which contain more sand than the major soils and are on dunes

### *Use and Management*

*Major uses:*
- This association supports native grasses used for grazing.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system

## 10. Blueridge-Bayard-Ashollow Association

*Very deep, gently sloping to very steep, excessively drained and well drained, loamy and sandy soils on hillslopes, alluvial fans, and stream terraces*

### *Setting*

*Landform:* Hillslopes, alluvial fans, and stream terraces
*Slope range:* 3 to 50 percent

### *Composition*

*Extent of the association in the county:* 1 percent
*Extent of components in the association:*
Blueridge soils—55 percent
Bayard soils—25 percent
Ashollow soils—11 percent
Minor soils—9 percent

### *Soil Properties and Qualities*

**Blueridge**

*Depth class:* Very deep
*Drainage class:* Excessively drained
*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Parent material:* Sandy and gravelly material
*Texture of the surface layer:* Loamy sand
*Slope:* 6 to 50 percent
*Depth to unconsolidated material that has rock fragments:* 0 to 20 inches

**Bayard**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes, alluvial fans, and stream terraces
*Position on the landform:* Foot slopes
*Parent material:* Loamy colluvial and alluvial material
*Texture of the surface layer:* Fine sandy loam
*Slope:* 3 to 20 percent

**Ashollow**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 3 to 20 percent

### *Minor Soils*

- Alice soils, which are deeper to carbonates than the major soils and are on stream terraces
- Otero soils, which have a light colored surface layer and are on stream terraces
- Scoville soils, which are sandy and are on stream terraces
- Jayem soils, which have carbonates below a depth of 40 inches and are on hillslopes

### *Use and Management*

*Major uses:*
- This association supports native grasses used for grazing.

*Management concerns:*
- Insufficient rainfall during the growing season
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system

## Excessively Drained and Well Drained, Sandy Soils on Hillslopes and Dunes

The soils in this group formed in sandy eolian material and in material weathered from calcareous sandstone. They are used mainly as rangeland.

## 11. Valent Association

*Very deep, rolling and hilly, excessively drained, sandy soils on dunes in the sandhills*

### Setting

*Landform:* Dunes (fig. 7)
*Slope range:* 9 to 60 percent

### Composition

*Extent of the association in the county:* 14 percent
*Extent of components in the association:*
Valent soils—85 percent
Minor soils—15 percent

### Soil Properties and Qualities

**Valent**

*Depth class:* Very deep
*Drainage class:* Excessively drained
*Landform:* Dunes
*Parent material:* Sandy eolian material
*Texture of the surface layer:* Fine sand
*Slope:* 9 to 60 percent

### Minor Soils

- Busher, Jayem, and Sarben soils, which are finer textured than the Valent soils and are on hillslopes and divides
- Tassel soils, which are shallow over calcareous sandstone and are on the summits and shoulders of hillslopes
- Blueridge soils, which are shallow to gravel and are on hillslopes

### Use and Management

*Major uses:*
- Most of the acreage supports native grasses used for grazing.

*Management concerns:*
- Soil blowing if the grass cover is destroyed
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system

## 12. Valent-Ashollow Association

*Very deep, nearly level to steep, well drained and excessively drained, sandy soils on hillslopes and dunes*

### Setting

*Landform:* Hillslopes and dunes
*Slope range:* 0 to 30 percent

### Composition

*Extent of the association in the county:* 1 percent
*Extent of components in the association:*
Valent soils—47 percent
Ashollow soils—36 percent
Minor soils—17 percent

### Soil Properties and Qualities

**Valent**

*Depth class:* Very deep
*Drainage class:* Excessively drained
*Landform:* Dunes
*Parent material:* Sandy eolian material
*Texture of the surface layer:* Fine sand and loamy fine sand
*Slope:* 0 to 30 percent
*Distinctive properties:* A high content of sand; highly susceptible to soil blowing

**Ashollow**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 3 to 30 percent

### Minor Soils

- Otero soils, which are on stream terraces
- Epping soils, which are shallow over siltstone and are on summits and shoulders
- Wildhorse soils, which are high in content of sodium and are on flood plains
- Mitchell soils, which are finer textured than the major soils and are on hillslopes and alluvial fans

### Use and Management

*Major uses:*
- This association supports native grasses used for grazing.

*Management concerns:*
- Proper range management
- Soil blowing and water erosion if the grass cover is destroyed

*Management measures:*
- Proper grazing use through a planned grazing system
- Timely deferment of grazing

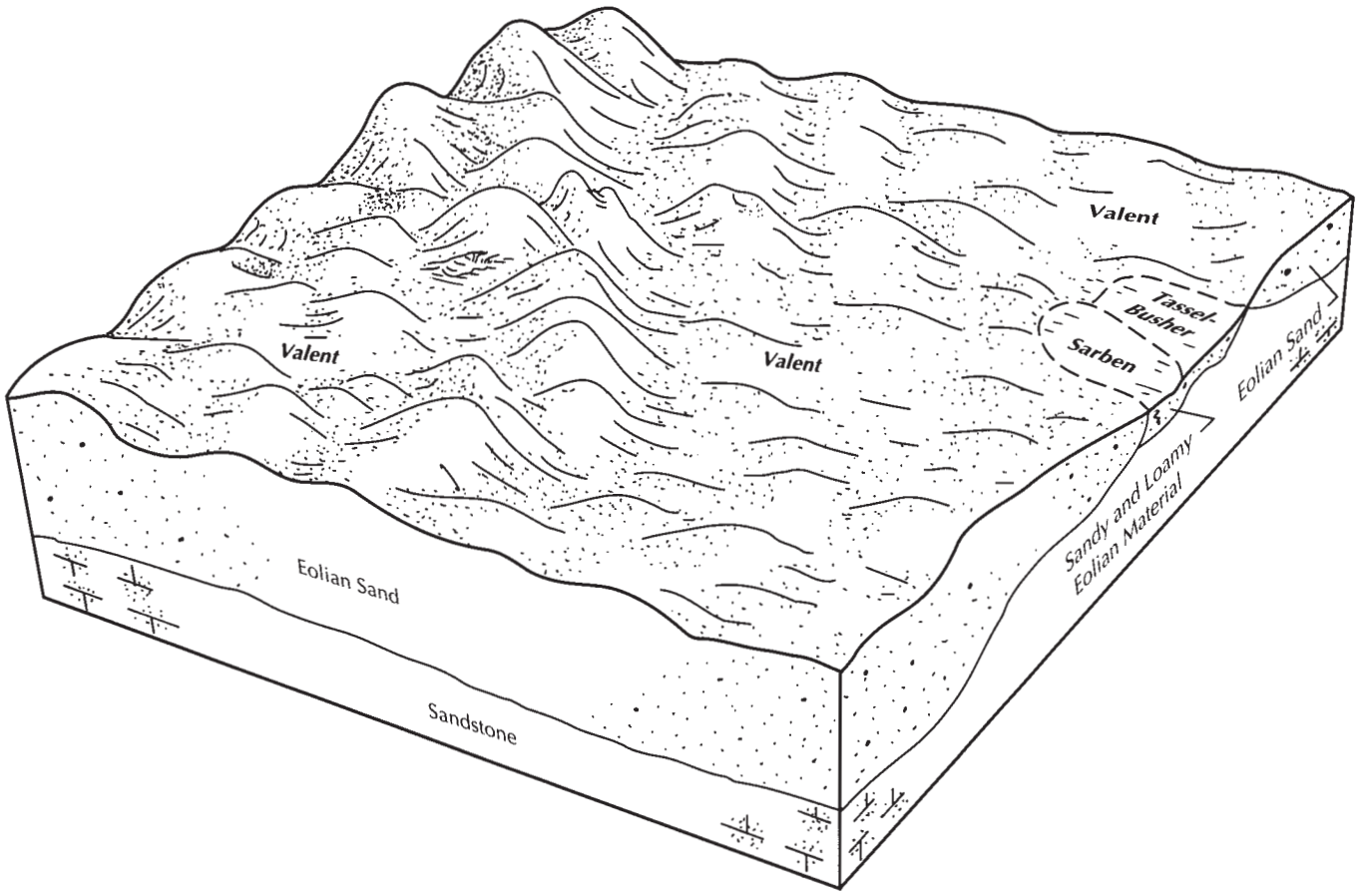


**Figure 7.—Typical pattern of soils and parent material in the Valent association.**

## Well Drained and Somewhat Excessively Drained, Sandy and Loamy Soils on Hillslopes, Alluvial Fans, and Stream Terraces

The soils in this group formed in alluvium and in material weathered from siltstone and calcareous sandstone. They are used as cropland and rangeland.

## 13. Mitchell-Otero-Ashollow Association

*Very deep, nearly level to steep, well drained, loamy and sandy soils on hillslopes, alluvial fans, and stream terraces*

### *Setting*

*Landform:* Hillslopes, alluvial fans, and stream terraces
*Slope range:* 0 to 30 percent

### *Composition*

*Extent of the association in the county:* 4 percent

*Extent of components in the association:*
Mitchell soils—31 percent
Otero soils—26 percent
Ashollow soils—16 percent
Minor soils—27 percent

### *Soil Properties and Qualities*

**Mitchell**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes and alluvial fans
*Position on the landform:* Foot slopes
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 0 to 30 percent

**Otero**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Loamy and sandy alluvium

*Texture of the surface layer:* Loamy very fine sand
*Slope:* 0 to 3 percent

**Ashollow**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Parent material:* Residuum weathered from calcareous sandstone
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 3 to 20 percent

### *Minor Soils*

- Bayard soils, which have a dark surface soil and are on hillslopes, stream terraces, and alluvial fans
- Epping soils, which are shallow over siltstone and are on the summits and shoulders of hillslopes
- Alice and Tripp soils, which have a dark surface soil, are deeper to carbonates than the major soils, and are on stream terraces
- Bankard and Las Animas soils, which are stratified and are on flood plains

### *Use and Management*

*Major uses:*
- Most of the acreage supports native grasses used for grazing. Some of the acreage is used for dryland or irrigated crops.

*Management concerns:*
- Insufficient rainfall during the growing season
- Soil blowing and water erosion in cultivated areas
- Proper irrigation water management
- Proper range management

*Management measures:*
- Conservation tillage and cover crops, which help to control soil blowing and water erosion and conserve soil moisture
- Cropping systems that maintain or improve the organic matter content and fertility
- Efficient use of irrigation water
- Proper grazing use through a planned grazing system

## 14. Scoville-Alice-Tripp Association

*Very deep, nearly level to gently sloping, well drained and somewhat excessively drained, sandy and loamy soils on stream terraces*

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 6 percent

### *Composition*

*Extent of the association in the county:* 2 percent
*Extent of components in the association:*
Scoville soils—50 percent
Alice soils—20 percent
Tripp soils—13 percent
Minor soils—17 percent

### *Soil Properties and Qualities*

**Scoville**

*Depth class:* Very deep
*Drainage class:* Somewhat excessively drained
*Landform:* Stream terraces
*Parent material:* Sandy alluvium over loamy alluvium
*Texture of the surface layer:* Fine sand and loamy fine sand
*Slope:* 0 to 3 percent
*Distinctive property:* A loamy buried layer at a depth of 40 to 60 inches

**Alice**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Fine sandy loam
*Slope:* 0 to 6 percent

**Tripp**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 0 to 3 percent

### *Minor Soils*

- Valent soils, which formed in sandy eolian material and are on dunes
- Bayard soils, which have a dark surface soil, are shallower to lime than the major soils, and are on similar landscapes
- Sarben soils, which have a light colored surface layer and are on hillslopes
- Las Animas soils, which are stratified and are on flood plains

### *Use and Management*

*Major uses:*
- Most of the acreage is used for irrigated crops. A small acreage is used for dryland crops or supports native grasses used for grazing.

*Management concerns:*
- Insufficient rainfall during the growing season
- Controlling water erosion and soil blowing in cultivated areas
- Proper irrigation water management

*Management measures:*
- Efficient use of irrigation water
- Conservation tillage and cover crops, which help to control soil blowing and water erosion and conserve soil moisture
- Cropping systems that maintain or improve the organic matter content and fertility on cropland

## Well Drained and Somewhat Poorly Drained, Clayey, Loamy, and Sandy Soils on Flood Plains and Stream Terraces

The soils in this group formed in alluvium and in material weathered from calcareous sandstone and shale. They are used as rangeland and cropland.

## 15. Craft-Bufton-Lohmiller Association

*Very deep, nearly level and very gently sloping, well drained, loamy and clayey soils on flood plains and stream terraces*

### *Setting*

*Landform:* Flood plains and stream terraces
*Slope range:* 0 to 3 percent

### *Composition*

*Extent of the association in the county:* 1 percent
*Extent of components in the association:*
Craft soils—34 percent
Bufton soils—24 percent
Lohmiller soils—22 percent
Minor soils—20 percent

### *Soil Properties and Qualities*

**Craft**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Flood plains
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Loam
*Slope:* 0 to 2 percent

**Bufton**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Colluvial and alluvial material weathered from shale
*Texture of the surface layer:* Clay loam
*Slope:* 0 to 3 percent

**Lohmiller**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Flood plains
*Parent material:* Clayey alluvium
*Texture of the surface layer:* Silty clay loam and silty clay
*Slope:* 0 to 2 percent

### *Minor Soils*

- Arvada and Skilak soils, which are high in content of sodium and are on stream terraces
- Glenberg soils, which contain less clay and more sand than the major soils and are on flood plains
- Kyle soils, which contain more clay than the major soils and are on stream terraces

### *Use and Management*

*Major uses:*
- Most the acreage supports native grasses used for grazing. A small acreage is used as cropland.

*Management concerns:*
- Insufficient rainfall during the growing season
- Flooding following periods of heavy rainfall
- Droughtiness
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system
- Conservation tillage and cover crops, which help to control soil blowing and conserve soil moisture

## 16. Glenberg-Vetal Association

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

### *Setting*

*Landform:* Flood plains and stream terraces
*Slope range:* 0 to 6 percent

### *Composition*

*Extent of the association in the county:* Less than 1 percent
*Extent of components in the association:*
Glenberg soils—66 percent
Vetal soils—20 percent
Minor soils—14 percent

### Soil Properties and Qualities

**Glenberg**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Flood plains
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Fine sandy loam
*Slope:* 0 to 2 percent

**Vetal**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 0 to 6 percent

### Minor Soils

- Craft soils, which are finer textured than the major soils and are on flood plains
- Lohmiller soils, which formed in clayey alluvium and are on flood plains
- Bridget soils, which are finer textured than the major soils and are on foot slopes

### Use and Management

*Major uses:*
- Most of the acreage supports native grasses used for grazing or hay. The rest is used as cropland.

*Management concerns:*
- Insufficient rainfall during the growing season
- Flooding following periods of heavy rainfall
- Controlling soil blowing on cropland
- Proper range management

*Management measures:*
- Proper grazing use through a planned grazing system
- Conservation tillage and cover crops, which help to control soil blowing and conserve soil moisture on cropland

## 17. Otero-Las Animas-Lisco Association

*Very deep, nearly level and very gently sloping, well drained and somewhat poorly drained, loamy and sandy soils on flood plains and stream terraces*

### Setting

*Landform:* Flood plains and stream terraces
*Slope range:* 0 to 3 percent

### Composition

*Extent of the association in the county:* 2 percent
*Extent of components in the association:*
Otero soils—27 percent
Las Animas soils—24 percent
Lisco soils—16 percent
Minor soils—33 percent

### Soil Properties and Qualities

**Otero**

*Depth class:* Very deep
*Drainage class:* Well drained
*Landform:* Stream terraces
*Parent material:* Loamy and sandy alluvium
*Texture of the surface layer:* Loamy very fine sand
*Slope:* 0 to 3 percent

**Las Animas**

*Depth class:* Very deep
*Drainage class:* Somewhat poorly drained
*Landform:* Flood plains
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Fine sandy loam
*Slope:* 0 to 2 percent

**Lisco**

*Depth class:* Very deep
*Drainage class:* Somewhat poorly drained
*Landform:* Flood plains
*Parent material:* Loamy alluvium
*Texture of the surface layer:* Very fine sandy loam
*Slope:* 0 to 2 percent
*Distinctive property:* These soils are affected by sodium and other salts.

### Minor Soils

- Ashollow soils, which formed in residuum weathered from calcareous sandstone and are on hillslopes
- Jayem soils, which have a dark surface soil and are on hillslopes
- Pathfinder soils, which are affected by sodium and other salts and are on flood plains
- Bigwinder soils, which have a water table at a depth of 1 to 3 feet and are on flood plains
- Bankard soils, which have more sand than the major soils and are on flood plains

### Use and Management

*Major uses:*
- Most of the acreage supports native grasses used for grazing or hay (fig. 8). The rest is used as cropland.

**Figure 8.—Native grass mowed for hay in an area of the Otero-Las Animas-Lisco association along the Niobrara River.**

*Management concerns:*
- Proper range management
- Insufficient rainfall during the growing season
- Flooding following periods of heavy rainfall
- Controlling soil blowing and improving fertility in cultivated areas

*Management measures:*
- Proper grazing use through a planned grazing system
- Conservation tillage and cover crops, which help to control soil blowing on cropland

# Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alliance loam, 1 to 3 percent slopes, is a phase of the Alliance series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Busher-Tassel complex, 0 to 6 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Tassel-Ponderosa-Rock outcrop association, 9 to 70 percent slopes, is an example.

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

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, variations in slope groupings, and application of the latest classification system.

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

## Ab—Alice fine sandy loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Irrigated cropland

### *Composition*

Alice soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
- Scoville soils—0 to 10 percent
- Tripp soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—brown, very friable fine sandy loam

*Subsurface layer:*
7 to 11 inches—brown, very friable very fine sandy loam

*Subsoil:*
11 to 26 inches—pale brown, very friable very fine sandy loam that is calcareous in the lower part

*Substratum:*
26 to 54 inches—pale brown, calcareous very fine sandy loam
54 to 60 inches—very pale brown, calcareous loamy fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.73 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Scoville soils, which contain more sand than the Alice soil and are on similar landscapes
- Tripp soils, which contain more silt and less sand than the Alice soil and are on similar landscapes
- Some areas where the surface soil and underlying material are loamy fine sand
- Some areas where deep cuts have exposed sandy material during land leveling

*Similar inclusions:*
- Soils that are dark to a depth of more than 20 inches
- Some areas where the light colored subsoil is exposed
- Some areas where the depth to lime is more than 60 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can deplete the protective plant cover and cause severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Suitability:* Well suited

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## AbB—Alice fine sandy loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Irrigated cropland

### *Composition*

Alice soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Scoville soils—0 to 10 percent
Tripp soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 10 inches—dark grayish brown, very friable fine sandy loam

*Subsoil:*
10 to 18 inches—grayish brown, very friable very fine sandy loam
18 to 23 inches—light brownish gray, very friable, calcareous very fine sandy loam
23 to 30 inches—light gray, very friable, calcareous very fine sandy loam

*Substratum:*
30 to 42 inches—light brownish gray, calcareous very fine sandy loam
42 to 60 inches—light brownish gray, calcareous loamy fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.78 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Scoville soils, which contain more sand than the Alice soil and are on similar landscapes
- Tripp soils, which contain more silt and less sand than the Alice soil and are on similar landscapes
- Some areas where the surface layer and underlying material are loamy fine sand
- Areas where deep cuts have exposed sandy material during land leveling

*Similar inclusions:*
- Soils that are dark to a depth of more than 20 inches
- Some areas where the light colored subsoil is exposed
- Some areas where lime is at a depth of more than 60 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can deplete the protective plant cover and result in severe soil blowing and water erosion.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Suitability:* Well suited

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## AbC—Alice fine sandy loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 3 to 6 percent (mainly 5 percent)
*Major use:* Irrigated cropland

### *Composition*

Alice soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Blueridge soils—0 to 5 percent
Scoville soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 10 inches—grayish brown, very friable fine sandy loam

*Subsoil:*
10 to 14 inches—grayish brown, very friable very fine sandy loam
14 to 21 inches—light brownish gray, very friable very fine sandy loam
21 to 36 inches—light gray, very friable, calcareous very fine sandy loam

*Substratum:*
36 to 60 inches—light gray, calcareous loamy fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.30 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)

*Parent material:* Loamy and sandy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Bridget soils, which contain more silt and less sand than the Alice soil and are in the higher areas
- Blueridge soils, which contain more sand and gravel than the Alice soil and are on the sides of valleys
- Scoville soils, which have more sand in the subsoil than the Alice soil and are on similar landscapes
- Soils that have a surface layer of loamy fine sand and do not have a layer of accumulated lime

*Similar inclusions:*
- Soils that are dark to a depth of more than 20 inches and are in swales
- Soils that are calcareous below a depth of 60 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing and water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling is required for gravity irrigation.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Suitability:* Well suited

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-3; irrigated—IIIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## AcB—Alliance loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Broad summits
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Alliance soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Keith soils—0 to 10 percent
Oglala soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—grayish brown, friable loam

*Subsoil:*
8 to 13 inches—grayish brown, firm silty clay loam
13 to 18 inches—brown, firm silty clay loam
18 to 26 inches—pale brown, friable silt loam

*Substratum:*
26 to 46 inches—pale brown, calcareous silt loam
46 to 60 inches—very pale brown, calcareous sandstone

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 40 to 60 inches (mainly 46 inches)
*Potential rooting depth:* Deep (40 to 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.02 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy loess over calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
- Keith soils, which do not have calcareous sandstone within a depth of 60 inches and are on landscapes similar to those of the Alliance soil
- Oglala soils, which contain less clay in the subsoil than the Alliance soil and are on rounded knobs on the higher parts of the landscape
- A few areas where the surface layer is fine sandy loam

*Similar inclusions:*
- Soils that are dark to a depth of more than 20 inches
- Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil
- Some areas where the subsoil is silt loam

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because land leveling would be required if surface irrigation methods were used.
- Leaving crop residue on the surface increases the rate of water intake.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills during heavy rains.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the depth to bedrock and the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.
- Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIe-1; irrigated—IIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## AcC—Alliance loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and shoulders
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Alliance soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Keith soils—10 percent
Oglala soils—5 percent

### *Typical Profile*

*Surface layer:*
0 to 9 inches—grayish brown, friable loam

*Subsoil:*
9 to 18 inches—brown, firm silty clay loam
18 to 22 inches—pale brown, firm silty clay loam
22 to 30 inches—pale brown, friable silt loam

*Substratum:*
30 to 47 inches—light gray, calcareous silt loam
47 to 60 inches—white, calcareous sandstone

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 40 to 60 inches (mainly 47 inches)
*Potential rooting depth:* Deep (40 to 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.20 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy loess over calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
- Keith soils, which do not have calcareous sandstone within a depth of 60 inches and are on landscapes similar to those of the Alliance soil
- Oglala soils, which have less clay in the subsoil than the Alliance soil and are on similar landscapes
- A few areas where the surface layer is fine sandy loam

*Similar inclusions:*
- Soils in which most of the original darkened surface

layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil
• Some areas where the subsoil is silt loam

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
• Leaving crop residue on the surface increases the rate of water intake.
• Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills during heavy rains.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the depth to bedrock and the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-1; irrigated—IIIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## ArB—Arvada loam, 0 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 3 percent (mainly 1 percent)
*Major use:* Rangeland

### *Composition*

Arvada soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Kyle soils—0 to 5 percent
Slickspots—0 to 10 percent
Bufton soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 inches to 1 inch—light brownish gray, friable, moderately alkaline loam

*Subsoil:*
1 to 14 inches—grayish brown, firm, calcareous, strongly alkaline silty clay
14 to 23 inches—light olive gray, firm, calcareous, strongly alkaline silty clay
23 to 60 inches—pale olive, firm, calcareous, moderately alkaline silty clay

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.10 inches)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Clayey and loamy alluvium and colluvium weathered from sodic shale
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate
*Distinctive property:* A high content of salts and sodium

### *Inclusions*

*Contrasting inclusions:*
• Kyle soils, which are not affected by alkali and are on stream terraces
• Slickspots, which are lower on the landscape than the Arvada soil and are so strongly affected by salts and sodium that they are devoid of vegetation
• Bufton soils, which are not affected by salts and sodium and are higher on the landscape than the Arvada soil

*Similar inclusions:*
• Soils that have a surface layer of clay or clay loam

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth.
• Careful management is needed in very strongly alkaline areas, which support little or no vegetation and are subject to severe soil blowing during dry periods.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Management concerns:* A severe limitation because of a high shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the very slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIs-1
*Windbreak suitability group:* 10
*Range site:* Panspots

## AwD—Ashollow loamy very fine sand, 3 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 3 to 9 percent (mainly 6 percent)
*Major uses:* Rangeland and irrigated cropland

### *Composition*

Ashollow soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Valent soils—0 to 5 percent
Bridget soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—brown, very friable loamy very fine sand

*Transitional layer:*
8 to 15 inches—pale brown, very friable, calcareous loamy very fine sand

*Substratum:*
15 to 60 inches—very pale brown, loose, calcareous loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.68 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Valent soils, which are sandy and are on hummocks and dunes
• Bridget soils, which are mollic, have more silt and less sand than the Ashollow soil, and are on similar landscapes

*Similar inclusions:*
• Soils that are leached of carbonates in the upper 40 inches and are on similar landscapes

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• A sprinkler system is the best method of irrigation

because frequent, light applications of water are needed.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control runoff and water erosion.
• Only the trees and shrubs that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited

**Septic tank absorption fields**

*Suitability:* Well suited

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 8
*Range site:* Sandy
*Irrigation design group:* 10

## AwE—Ashollow loamy very fine sand, 9 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes
*Slope range:* 9 to 20 percent (mainly 14 percent)
*Major use:* Rangeland

### *Composition*

Ashollow soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Valent soils—0 to 5 percent
Bridget soils—0 to 5 percent
Busher soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—dark grayish brown, very friable loamy very fine sand

*Transitional layer:*
6 to 15 inches—grayish brown, very friable, calcareous loamy very fine sand

*Substratum:*
15 to 60 inches—light gray, very friable, calcareous loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.68 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Valent soils, which are sandy and are on hummocks and dunes
• Bridget soils, which are mollic, have more silt and less sand than the Ashollow soil, and are on similar landscapes
• Busher soils, which have soft, calcareous sandstone at a depth of 40 to 60 inches, have a dark surface layer, and are on middle side slopes

*Similar inclusions:*
• Soils that are leached of carbonates in the upper 40 inches and are on similar landscapes

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control runoff and water erosion.
• Only the trees and shrubs that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
• Buildings should be designed so that they conform to the natural slope of the land, or the soil should be graded.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5
*Windbreak suitability group:* 8
*Range site:* Sandy

## Ba—Badland

### *Setting*

*Landform:* Hillslopes
*Slope range:* 0 to 100 percent (mainly 50 percent)
*Major use:* Wildlife habitat

### *Composition*

Badland: 80 percent
Contrasting inclusions:
Bufton soils—0 to 4 percent
Epping soils—0 to 4 percent
Thirtynine soils—0 to 4 percent
Norrest soils—0 to 4 percent
Orella soils—0 to 4 percent

### *Landscape Features*

• This map unit consists mainly of highly erodible exposures of siltstone, sandstone, and shale around the head of drainageways and on the sides of ridges and buttes. Vertical walls or escarpments several hundred feet high are common. Deep, narrow gullies are on the lower parts of the landscape. The terrain is extremely rough. The unit supports little or no vegetation.

### *Soil Properties and Qualities*

*Available water capacity:* Very low (less than 1 inch)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Weathered and unweathered bedrock consisting of siltstone, shale, and sandstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Very severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Bufton soils, which are deep and are on the lower parts of the landscape
• Epping and Orella soils, which are shallow over siltstone and silty shale and are on high parts of the landscape
• Thirtynine soils, which are deep over siltstone and are on the higher parts of the landscape
• Norrest soils, which are moderately deep over silty shale and are on the middle parts of the landscape

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Suitability:* Not suited

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:* Not suited

### *Interpretive Groups*

*Land capability classification:* Dryland—VIIIs-8
*Windbreak suitability group:* 10
*Range site:* None

## BbB—Bahl clay, 0 to 6 percent slopes

### *Setting*

*Landform:* Alluvial fans
*Slope range:* 0 to 6 percent (mainly 3 percent)
*Major use:* Rangeland

### *Composition*

Bahl soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Pierre soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 5 inches—light brownish gray, firm clay

*Substratum:*
5 to 28 inches—light gray, firm, calcareous clay
28 to 60 inches—light gray, calcareous clay

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained

*Available water capacity:* Moderate (6.1 inches)
*Permeability:* Slow
*Parent material:* Clayey alluvium
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe
*Distinctive property:* Accumulations of gypsum and carbonate in the substratum

### Inclusions

*Contrasting inclusions:*
- Pierre soils, which are 20 to 40 inches deep over shale and are on knobs
- Mitchell soils, which have less clay in the subsoil than the Bahl soil and are on similar landscapes

*Similar inclusions:*
- Soils with a surface layer of clay loam that is dark and is leached of lime

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills during heavy rains.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
- Planting on the contour helps to prevent excessive water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slow permeability.

### Interpretive Groups

*Land capability classification:* Dryland—IVs-2
*Windbreak suitability group:* 4C
*Range site:* Clayey
*Irrigation design group:* 3

## Bc—Bankard loamy fine sand, 0 to 2 percent slopes, occasionally flooded

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 0.5 percent)
*Major use:* Rangeland

### Composition

Bankard soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 10 percent
Craft soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—brown, very friable, calcareous loamy fine sand

*Substratum:*
4 to 11 inches—pale brown, calcareous fine sandy loam
11 to 48 inches—pale brown, calcareous fine sand stratified with fine sandy loam
48 to 60 inches—very pale brown, calcareous gravelly sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Low (4.47 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Glenberg soils, which have more silt and less sand in

the substratum than the Bankard soil and are on similar landscapes
• Craft soils, which have more silt and clay and less sand in the substratum than the Bankard soil and are on similar landscapes

*Similar inclusions:*
• Soils that have a surface layer of fine sandy loam or loam

### *Use and Management*

**Cultivated crops**

*Management concerns:* The occasional flooding
*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the surface as possible.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVw-5; irrigated—IVw-11
*Windbreak suitability group:* 7
*Range site:* Sandy Lowland
*Irrigation design group:* 11

## Bd—Bankard loamy fine sand, channeled, 0 to 2 percent slopes

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major use:* Rangeland

### *Composition*

Bankard soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 10 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—pale brown, very friable, calcareous loamy fine sand

*Substratum:*
7 to 17 inches—very pale brown, calcareous fine sand
17 to 40 inches—very pale brown, calcareous fine sand stratified with fine sandy loam and loamy sand
40 to 60 inches—very pale brown, calcareous gravelly sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Low (4.47 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Glenberg soils, which have less sand and more silt in the substratum than the Bankard soil and are on similar landscapes
• Valent soils, which do not have appreciable amounts of gravel and are on dunes

*Similar inclusions:*
• Some areas where the surface layer is darker and thicker than is typical
• Some areas where the surface layer is loamy very fine sand or fine sand

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Management considerations include channeling and the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed.

### Interpretive Groups

*Land capability classification:* Dryland—VIw-7
*Windbreak suitability group:* 10
*Range site:* Shallow to Gravel

## Be—Bayard fine sandy loam, 0 to 1 percent slopes

### Setting

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Irrigated cropland

### Composition

Bayard soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Blueridge soils—0 to 5 percent
Bridget soils—0 to 5 percent
Tripp soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—brown, very friable fine sandy loam

*Subsurface layer:*
6 to 12 inches—grayish brown, very friable fine sandy loam

*Transitional layer:*
12 to 18 inches—pale brown, very friable fine sandy loam

*Substratum:*
18 to 33 inches—pale brown, calcareous fine sandy loam
33 to 60 inches—very pale brown, calcareous loamy very fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.72 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy colluvial and alluvial material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
• Bridget soils, which contain more silt and less sand than the Bayard soil and are on foot slopes
• Blueridge soils, which are shallow to gravel and are on narrow ridges
• Tripp soils, which contain more silt and less sand than the Bayard soil and are on similar landscapes

*Similar inclusions:*
• Soils that are dark to a depth of more than 20 inches
• Soils in which the dark upper layers have been removed by land leveling and the lighter colored subsoil is exposed
• Soils in which the surface layer is loamy fine sand
• Soils in which lime is leached below a depth of 20 inches

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.
• When land leveling is needed, deep cuts that expose the sandy underlying material should be avoided.

• Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## BeB—Bayard fine sandy loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Irrigated cropland

### *Composition*

Bayard soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Blueridge soils—0 to 5 percent
Bridget soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—brown, very friable fine sandy loam

*Transitional layer:*
8 to 15 inches—brown, very friable, calcareous fine sandy loam

*Substratum:*
15 to 60 inches—light gray, calcareous loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.72 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy colluvial and alluvial material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Blueridge soils, which are shallow to gravel and are on narrow ridges
• Bridget soils, which contain more silt and less sand than the Bayard soil and are on similar landscapes
• Mitchell soils, which do not have a dark surface soil, contain more silt and less sand than the Bayard soil, and are on similar landscapes

*Similar inclusions:*
• Soils in which the dark upper layers have been removed by land leveling and the lighter colored subsoil has been exposed
• Soils in which the surface layer is loamy fine sand
• Soils in which lime is leached below a depth of 20 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Gravity and sprinkler irrigation systems can be used.
• When land leveling is needed, deep cuts that expose the sandy underlying material should be avoided.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded

to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## BeC—Bayard fine sandy loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Alluvial fans
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major use:* Irrigated cropland

### *Composition*

Bayard soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Blueridge soils—0 to 5 percent
Bridget soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—dark brown, very friable fine sandy loam

*Subsurface layer:*
6 to 14 inches—brown, very friable fine sandy loam

*Transitional layer:*
14 to 19 inches—pale brown, very friable, calcareous fine sandy loam

*Substratum:*
19 to 32 inches—very pale brown, calcareous fine sandy loam
32 to 60 inches—very pale brown, calcareous loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.72 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy colluvial and alluvial material
*Surface runoff:* Medium
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Blueridge soils, which are shallow to gravel and are on ridges
• Bridget soils, which contain more silt and less sand than the Bayard soil and are on similar landscapes
• Mitchell soils, which do not have a dark surface soil, contain more silt and less sand than the Bayard soil, and are on similar landscapes

*Similar inclusions:*
• Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil
• Soils in which the surface layer is loamy fine sand or very fine sandy loam
• Soils in which lime is leached below a depth of 20 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required for gravity irrigation.
• Terraces, contour farming, and grassed waterways help to control water erosion.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded

to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• Contour planting conserves soil moisture and helps to control runoff and erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-3; irrigated—IIIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## Bh—Bigwinder fine sandy loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 1 percent (mainly 1 percent)
*Major use:* Rangeland

### *Composition*

Bigwinder soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Las Animas soils—0 to 5 percent
Fluvaquents, sandy—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—gray, very friable, calcareous fine sandy loam

*Transitional layer:*
4 to 12 inches—light gray, very friable, calcareous very fine sandy loam

*Substratum:*
12 to 39 inches—light gray, calcareous loamy very fine sand stratified with fine sandy loam
39 to 43 inches—light gray, calcareous very fine sandy loam
43 to 60 inches—light gray, calcareous loamy very fine sand stratified with sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* More than 40 inches
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Poorly drained
*Depth to a seasonal high water table:* 1 to 3 feet
*Available water capacity:* Moderate (7.2 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Stratified loamy and sandy alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Las Animas soils, which have a lower water table than the Bigwinder soil and are higher on the landscape
• Fluvaquents, sandy, which are on the lowest parts of the landscape and are ponded for long periods

*Similar inclusions:*
• Some areas where the soil has a dark surface layer that is 7 or more inches thick
• Some areas where the surface layer is very fine sandy loam or loamy very fine sand

### *Use and Management*

**Rangeland and hay**

*Management measures:*
• Reed canarygrass and creeping foxtail can be grown on this poorly drained soil.
• Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth and can deplete the protective plant cover, resulting in severe soil blowing. Also, grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.
• In wet years some areas of this soil cannot be harvested for hay.
• After the ground is frozen, livestock can graze without

damaging the meadows. The livestock should be removed in spring, before the ground thaws.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIw-7
*Windbreak suitability group:* 10
*Range site:* Wet Land

## BoG—Blueridge gravelly loamy sand, 20 to 50 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Slope range:* 20 to 50 percent (mainly 35 percent)
*Major use:* Rangeland

### *Composition*

Blueridge soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bayard soils—0 to 5 percent
Epping soils—0 to 5 percent
Siltstone outcrops—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 3 inches—dark grayish brown, very friable gravelly loamy sand

*Substratum:*
3 to 6 inches—grayish brown very gravelly coarse sand
6 to 60 inches—light gray very gravelly coarse sand

### *Soil Properties and Qualities*

*Depth to unconsolidated material that has rock fragments:* 0 to 20 inches (mainly 5 inches)
*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Very low (2.99 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the surface layer, very rapid (more than 20 inches/hour) in the substratum
*Parent material:* Sandy and gravelly material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe
*Distinctive property:* This soil is very droughty because of a high content of gravel.

### *Inclusions*

*Contrasting inclusions:*
• Bayard soils, which contain more sand than the Blueridge soil, have less than 5 percent gravel, and are in swales on the lower parts of the landscape
• Epping soils, which are shallow over siltstone and are on convex summits on the higher parts of the landscape
• Some areas where siltstone crops out on the steepest parts of the landscape

*Similar inclusions:*
• Some areas where the surface soil is dark fine sandy loam or fine sand and contains less than 15 percent gravel, by volume
• Some soils that contain more than 35 percent gravel, by volume

### *Use and Management*

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIIs-4
*Windbreak suitability group:* 10
*Range site:* Shallow to Gravel

## BpE—Blueridge-Bayard complex, 6 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Blueridge—back slopes, shoulders, and summits; Bayard—alluvial fans and the foot slopes of hillslopes
*Slope range:* Blueridge—6 to 20 percent (mainly 15 percent); Bayard—6 to 20 percent (mainly 8 percent)
*Major use:* Rangeland

### *Composition*

Blueridge soil and similar soils: 50 percent (plus or minus 10 percent)
Bayard soil and similar soils: 35 percent (plus or minus 10 percent)
Contrasting inclusions:
Epping soils—0 to 5 percent
Valent soils—0 to 10 percent

### *Typical Profile*

**Blueridge**

*Surface layer:*
0 to 5 inches—dark grayish brown, very friable loamy sand

*Transitional layer:*
5 to 12 inches—dark brown, loose, calcareous gravelly coarse sand

*Substratum:*
12 to 60 inches—very pale brown gravelly coarse sand

**Bayard**

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
8 to 16 inches—brown, very friable fine sandy loam

*Substratum:*
16 to 23 inches—pale brown, calcareous fine sandy loam
23 to 60 inches—very pale brown, calcareous loamy fine sand

### *Soil Properties and Qualities*

**Blueridge**

*Depth to unconsolidated material that has rock fragments:* 0 to 20 inches (mainly 10 inches)
*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Very low (2.99 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the surface layer, very rapid (more than 20 inches/hour) in the substratum
*Parent material:* Sandy and gravelly material.
*Surface runoff:* Slow
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe
*Distinctive property:* This soil is very droughty because of a high content of gravel.

**Bayard**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.54 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy colluvial and alluvial material
*Surface runoff:* Moderate
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Epping soils, which are shallow over siltstone and are on convex summits on the higher parts of the landscape
- Valent soils, which have less than 2 percent gravel, by volume, and are on dunes
- Areas where the surface layer is loamy fine sand
- Areas where the surface layer is loam and gravel is at a depth of 20 to 40 inches

*Inclusions similar to the Blueridge soil:*
- Areas that have a dark surface soil
- Areas that have more than 35 percent gravel, by volume

*Inclusions similar to the Bayard soil:*
- Areas where lime is leached to a depth of more than 20 inches

### Use and Management

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Blueridge*

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

*Bayard*

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A moderate limitation because of the slope of both soils
*Management measures:*
• Grading helps to keep surface runoff away from the buildings.
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

**Septic tank absorption fields**

*Blueridge*

*Management concerns:* Severe limitations because of the very rapid permeability and a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

*Bayard*

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### Interpretive Groups

*Land capability classification:* Blueridge—VIs-4, dryland; Bayard—VIe-3, dryland
*Windbreak suitability group:* Blueridge—10; Bayard—5
*Range site:* Blueridge—Shallow to Gravel; Bayard—Sandy

## BrC—Bridget very fine sandy loam, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 3 to 6 percent (mainly 5 percent)
*Major uses:* Cropland and rangeland

### Composition

Bridget soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Ponderosa soils—0 to 5 percent
Vetal soils—0 to 10 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
8 to 13 inches—grayish brown, very friable, calcareous very fine sandy loam

*Substratum:*
13 to 60 inches—pale brown, calcareous very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)

*Parent material:* Loamy colluvial and alluvial sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Ponderosa soils, which have more sand in the subsoil than the Bridget soil
- Vetal soils, which have more sand in the subsoil than the Bridget soil and have a dark surface layer that is more than 20 inches thick

*Similar inclusions:*
- Soils that have a surface layer of loamy very fine sand
- Soils in areas where water erosion has removed all of the surface layer and has exposed the underlying material
- Areas that have a dark surface layer that is more than 20 inches thick and are leached of lime below a depth of 15 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIIe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## BrD—Bridget very fine sandy loam, 6 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 6 to 9 percent (mainly 8 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Bridget soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Ponderosa soils—0 to 5 percent
Vetal soils—0 to 10 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
8 to 15 inches—dark grayish brown, very friable, calcareous very fine sandy loam

*Substratum:*
15 to 60 inches—pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained

*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy colluvial and alluvial sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Ponderosa soils, which have more sand and less silt than the Bridget soil and are on similar landscapes
- Vetal soils, which have more sand in the subsoil than the Bridget soil and are in swales below the Bridget soil

*Similar inclusions:*
- Soils in areas where water erosion has removed all of the surface layer and has exposed the underlying material
- Soils that have a dark surface layer that is more than 20 inches thick and are leached of lime to a depth of more than 15 inches
- Soils that have a surface layer of loamy very fine sand

### Use and Management

#### Cultivated crops

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

#### Rangeland and hay

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

#### Windbreaks

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.

#### Dwellings

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

#### Septic tank absorption fields

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-3; irrigated—IVe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## BrF—Bridget very fine sandy loam, 9 to 30 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 9 to 30 percent (mainly 20 percent)
*Major use:* Rangeland

### Composition

Bridget soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Ponderosa soils—0 to 5 percent
Oglala soils—0 to 5 percent
Ashhollow soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 7 inches—grayish brown, very friable very fine sandy loam

*Transitional layer:*
7 to 13 inches—brown, very friable very fine sandy loam

*Substratum:*
13 to 60 inches—pale brown, calcareous very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy colluvial and alluvial sediments
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Ponderosa soils, which have more sand and less silt than the Bridget soil and are in similar positions on the landscape
• Ashollow soils, which have more sand, less silt, and a thinner and lighter colored surface layer than the Bridget soil and are higher on the landscape
• Oglala soils, which have bedrock at a depth of 40 to 60 inches and are on knobs above the Bridget soil

*Similar inclusions:*
• Soils that have a lighter colored surface layer and have lime higher in the profile
• Soils that are dark to a depth of more than 20 inches and are leached of lime to a greater depth
• Soils that have a surface layer of loamy very fine sand

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:* Suited only in areas where the slope is less than 15 percent
• Onsite investigation is needed to identify the best suited areas.
*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.
• Grading helps to keep surface runoff away from the buildings.

**Septic tank absorption fields**

*Suitability:* Suited only in areas where the slope is less than 15 percent
• Onsite investigation is needed to identify the best suited areas.
*Management concerns:* Severe limitations because of the slope and the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-3
*Windbreak suitability group:* 10
*Range site:* Silty

## Bs—Bufton clay loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Bufton soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Kyle soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—light brownish gray, friable clay loam

*Subsoil:*
4 to 26 inches—light gray, firm, calcareous silty clay loam
26 to 36 inches—very pale brown, firm, calcareous silty clay loam

*Substratum:*
36 to 60 inches—white, calcareous silty clay loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.4 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Parent material:* Colluvial and alluvial material weathered from shale
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate
*Distinctive properties:* In some areas the subsoil and substratum are strongly alkaline. Chalcedony fragments are commonly on the surface and throughout the profile.

### *Inclusions*

*Contrasting inclusions:*
- Arvada soils, which are strongly affected by salts and alkalinity and are in landscape positions similar to those of the Bufton soil
- Kyle soils, which contain more clay than the Bufton soil and are in similar landscape positions
- Mitchell soils, which contain less clay than the Bufton soil and are in similar landscape positions

*Similar inclusions:*
- Soils that have a dark surface layer and are leached of lime to a greater depth
- Soils that have an increase in content of clay in the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIs-2; irrigated—IIIs-3
*Windbreak suitability group:* 4L
*Range site:* Clayey
*Irrigation design group:* 3

## BsB—Bufton clay loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Summits of hillslopes and stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Bufton soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Kyle soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—grayish brown, friable clay loam

*Subsoil:*
6 to 12 inches—grayish brown, firm silty clay loam
12 to 36 inches—light brownish gray, firm, calcareous silty clay loam

*Substratum:*
36 to 60 inches—light gray, calcareous silty clay loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.66 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Colluvial and alluvial material weathered from shale
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

*Distinctive properties:* In some areas the subsoil and substratum are strongly alkaline. Chalcedony fragments are commonly on the surface and throughout the profile.

### *Inclusions*

*Contrasting inclusions:*
- Arvada soils, which are strongly affected by salts and alkalinity and are in landscape positions similar to those of the Bufton soil
- Kyle soils, which contain more clay than the Bufton soil and are in similar landscape positions
- Mitchell soils, which have less clay in the subsoil than the Bufton soil and are in similar landscape positions

*Similar inclusions:*
- Soils that have a few inches of dark surface soil and are leached of lime to a greater depth
- Soils that have a slight increase in content of clay in the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential

*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-1; irrigated—IIIe-3
*Windbreak suitability group:* 4L
*Range site:* Clayey
*Irrigation design group:* 3

## BsD—Bufton clay loam, 3 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits, back slopes, and foot slopes
*Slope range:* 3 to 9 percent (mainly 4 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Bufton soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Mitchell soils—5 percent
Norrest soils—5 percent
Pierre soils—5 percent

### *Typical Profile*

*Surface layer:*
0 to 5 inches—grayish brown, firm clay loam

*Subsoil:*
5 to 27 inches—brown, firm, calcareous silty clay loam
27 to 35 inches—pale brown, firm, calcareous silty clay loam

*Substratum:*
35 to 60 inches—very pale brown, calcareous clay loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.90 inches)
*Permeability:* Slow

*Parent material:* Colluvial and alluvial material weathered from shale
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate
*Distinctive properties:* In some areas the subsoil and substratum are strongly alkaline. Chalcedony fragments are commonly on the surface and throughout the profile.

### *Inclusions*

*Contrasting inclusions:*
- Mitchell soils, which have less clay in the subsoil than the Bufton soil and are in similar positions on the landscape
- Norrest soils, which are moderately deep and are on hillsides above the Bufton soil
- Pierre soils, which contain more clay throughout than the Bufton soil, are moderately deep, and are in areas above the Bufton soil

*Similar inclusions:*
- Soils that have a few inches of dark surface soil and are leached of lime to a greater depth
- Soils that have a slight increase in content of clay in the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Terraces, contour farming, and grassed waterways help to control water erosion.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-1; irrigated—IVe-3
*Windbreak suitability group:* 4L
*Range site:* Clayey
*Irrigation design group:* 3

## BsE—Bufton clay loam, 9 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits and back slopes
*Slope range:* 9 to 20 percent (mainly 14 percent)
*Major use:* Rangeland

### *Composition*

Bufton soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Mitchell soils—0 to 5 percent
Orella soils—0 to 5 percent
Pierre soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—dark grayish brown, firm clay loam

*Subsoil:*
4 to 10 inches—brown, firm silty clay loam
10 to 15 inches—pale brown, firm, calcareous silty clay loam
15 to 25 inches—very pale brown, firm, calcareous silty clay loam

*Substratum:*
25 to 60 inches—very pale brown, calcareous silty clay loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.40 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Colluvial and alluvial material weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate
*Distinctive properties:* In some areas the subsoil and substratum are strongly alkaline. Chalcedony fragments are commonly on the surface and throughout the profile.

### Inclusions

*Contrasting inclusions:*
- Mitchell soils, which contain less clay than the Bufton soil and are in similar landscape positions
- Orella soils, which are shallow and are on ridges and knolls above the Bufton soil
- Pierre soils, which are moderately deep and are higher on the landscape than the Bufton soil

*Similar inclusions:*
- Soils that have a few inches of dark surface soil and are leached of lime to a greater depth
- Soils that have a slight increase in content of clay in the subsoil

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* Severe limitations because of the shrink-swell potential and the slope
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.
- Grading helps to keep surface runoff away from the buildings.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slow permeability.

### Interpretive Groups

*Land capability classification:* Dryland—VIe-1
*Windbreak suitability group:* 4L
*Range site:* Clayey

## BuB—Busher loamy very fine sand, 0 to 3 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major use:* Rangeland

### Composition

Busher soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Phiferson soils—0 to 5 percent
Sarben soils—0 to 5 percent
Tassel soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable loamy very fine sand

*Subsoil:*
8 to 25 inches—brown, very friable loamy very fine sand

*Substratum:*
25 to 40 inches—pale brown, calcareous loamy very fine sand
40 to 50 inches—light gray, calcareous loamy very fine sand that has 5 percent gravel-sized sandstone fragments, by volume
50 to 60 inches—light gray, soft, calcareous sandstone

### Soil Properties and Qualities

*Depth to paralithic contact:* 40 to 60 inches (mainly 50 inches)
*Depth to unconsolidated material that has rock fragments:* 35 to 50 inches (mainly 45 inches)
*Potential rooting depth:* 40 to 60 inches
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.12 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
• Phiferson soils, which have calcareous sandstone bedrock at a depth of 20 to 40 inches and are in areas above the Busher soil
• Sarben soils, which have a light colored surface layer and do not have bedrock within a depth of 60 inches
• Tassel soils, which are 6 to 20 inches deep over bedrock and are in the higher, convex positions on the landscape

*Similar inclusions:*
• Some areas where the surface layer is very fine sandy loam or fine sandy loam
• Some areas where the dark material making up the surface layer is more than 20 inches thick and a few areas where it is less than 7 inches thick
• Some areas where calcareous sandstone bedrock is below a depth of 60 inches

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Management concerns:* A slight limitation because of the depth to bedrock
*Management measures:*
• The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the depth to bedrock
*Management measures:*
• Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### Interpretive Groups

*Land capability classification:* Dryland—IIIe-5; irrigated—IIIe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## BuC—Busher loamy very fine sand, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits, back slopes, and foot slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major use:* Rangeland

### Composition

Busher soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Phiferson soils—0 to 5 percent
Sarben soils—0 to 5 percent
Tassel soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable loamy very fine sand

*Subsoil:*
8 to 25 inches—brown, very friable loamy very fine sand

*Substratum:*
25 to 40 inches—pale brown, calcareous loamy very fine sand
40 to 50 inches—light gray, calcareous loamy very fine sand that has 7 percent gravel-sized sandstone fragments, by volume
50 to 60 inches—light gray, soft, calcareous sandstone

### Soil Properties and Qualities

*Depth to paralithic contact:* 40 to 60 inches (mainly 50 inches)
*Depth to unconsolidated material that has rock fragments:* 35 to 50 inches (mainly 40 inches)
*Potential rooting depth:* 40 to 60 inches
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.12 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Phiferson soils, which have calcareous sandstone at a depth of 20 to 40 inches and are higher on the landscape than the Busher soil
- Sarben soils, which have a light colored surface layer and do not have bedrock within a depth of 60 inches
- Tassel soils, which are 6 to 20 inches deep over bedrock and are in the higher, convex positions on the landscape

*Similar inclusions:*
- Some areas where the surface soil is very fine sandy loam or fine sandy loam
- Some areas where the dark material making up the surface layer is more than 20 inches thick and a few areas where it is less than 7 inches thick
- Some areas where the sandstone bedrock is below a depth of 60 inches

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Management concerns:* A slight limitation because of the depth to bedrock
*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the depth to calcareous sandstone
*Management measures:*
- Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## BuD—Busher loamy very fine sand, 6 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits, back slopes, and foot slopes
*Slope range:* 6 to 9 percent (mainly 7 percent)
*Major use:* Rangeland

### Composition

Busher soil and similar soils: 85 percent (plus or minus 5 percent)

Contrasting inclusions:
Phiferson soils—0 to 5 percent
Sarben soils—0 to 5 percent
Tassel soils—0 to 5 percent

## Typical Profile

*Surface layer:*
0 to 8 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
8 to 18 inches—brown, very friable loamy very fine sand
18 to 28 inches—brown, very friable loamy very fine sand

*Substratum:*
28 to 41 inches—pale brown, calcareous loamy very fine sand that has 8 percent gravel-sized sandstone fragments, by volume
41 to 60 inches—light gray, calcareous sandstone

## Soil Properties and Qualities

*Depth to paralithic contact:* 40 to 60 inches (mainly 50 inches)
*Depth to unconsolidated material that has rock fragments:* 25 to 40 inches (mainly 28 inches)
*Potential rooting depth:* 40 to 60 inches
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (6.68 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

## Inclusions

*Contrasting inclusions:*
• Phiferson soils, which have calcareous sandstone at a depth of 20 to 40 inches and are in areas above the Busher soil
• Sarben soils, which have a light colored surface layer and do not have bedrock within a depth of 60 inches
• Tassel soils, which are 6 to 20 inches deep over bedrock and are in the higher, convex positions on the landscape

*Similar inclusions:*
• Some areas where the surface soil is very fine sandy loam or fine sandy loam
• Some areas where the dark material making up the surface layer is more than 20 inches thick and a few areas where it is less than 7 inches thick
• Some areas where the sandstone bedrock is within a depth of 40 inches

## Use and Management

### Cultivated crops

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.

### Rangeland and hay

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

### Windbreaks

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

### Dwellings

*Management concerns:* A slight limitation because of the depth to calcareous sandstone
*Management measures:*
• Grading helps to keep surface runoff away from the buildings.
• The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

### Septic tank absorption fields

*Management concerns:* A moderate limitation because of the depth to calcareous sandstone
*Management measures:*
• Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

## Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## BwC—Busher-Phiferson complex, 0 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Busher—back slopes and foot slopes; Phiferson—shoulders
*Slope range:* Busher—0 to 6 percent (mainly 3 percent); Phiferson—0 to 6 percent (mainly 5 percent)
*Major use:* Rangeland

### Composition

Busher soil and similar soils: 50 percent (plus or minus 10 percent)
Phiferson soil and similar soils: 35 percent (plus or minus 10 percent)
Contrasting inclusions:
Jayem soils—0 to 10 percent
Tassel soils—0 to 5 percent

### Typical Profile

**Busher**

*Surface layer:*
0 to 10 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
10 to 22 inches—pale brown, friable loamy very fine sand

*Substratum:*
22 to 33 inches—pale brown, loose loamy very fine sand
33 to 51 inches—very pale brown, loose, calcareous loamy very fine sand that has 10 percent gravel-sized sandstone fragments, by volume
51 to 60 inches—white, calcareous sandstone

**Phiferson**

*Surface layer:*
0 to 9 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
9 to 22 inches—pale brown, very friable loamy very fine sand

*Substratum:*
22 to 31 inches—very pale brown, very friable loamy very fine sand
31 to 37 inches—very pale brown, loose, calcareous loamy very fine sand that has 10 percent gravel-sized sandstone fragments, by volume
37 to 60 inches—white, calcareous sandstone

### Soil Properties and Qualities

**Busher**

*Depth to paralithic contact:* 40 to 60 inches (mainly 55 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 50 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.12 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

**Phiferson**

*Depth to paralithic contact:* 20 to 40 inches (mainly 23 inches)
*Potential rooting depth:* 20 to 40 inches (mainly 30 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (4.0 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Jayem soils, which have sandstone bedrock below a depth of 60 inches and are in concave areas on low parts of the landscape
- Tassel soils, which have sandstone bedrock within a depth of 20 inches and are on knobs above the Busher and Phiferson soils

*Inclusions similar to the Busher soil:*
- Soils that have a surface layer of very fine sandy loam and are dark below a depth of 20 inches

*Inclusions similar to the Phiferson soil:*
- Soils that have a surface layer of very fine sandy loam

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- A sprinkler system is the best method of irrigation

because extensive land leveling would be required if surface irrigation methods were used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Busher*

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

*Phiferson*

*Suitability for dwellings without basements:* Well suited
- Limitations are slight and can be easily overcome.

*Management concerns on sites for dwellings with basements:* A moderate limitation because of the depth to bedrock

*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Suitability:* Busher—suited; Phiferson—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Busher*

*Management concerns:* A moderate limitation because of the depth to calcareous sandstone

*Management measures:*
- Fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### *Interpretive Groups*

*Land capability classification:* Busher—IVe-5, dryland, and IVe-10, irrigated; Phiferson—IVe-5, dryland, and IVe-10, irrigated

*Windbreak suitability group:* Busher—5; Phiferson—6R
*Range site:* Busher—Sandy; Phiferson—Sandy
*Irrigation design group:* 10

## BxC—Busher-Tassel complex, 0 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Busher—back slopes and foot slopes; Tassel—summits and shoulders
*Slope range:* Busher—0 to 6 percent (mainly 3 percent); Tassel—3 to 6 percent (mainly 5 percent)
*Major use:* Rangeland

### *Composition*

Busher soil and similar soils: 57 percent (plus or minus 10 percent)
Tassel soil and similar soils: 23 percent (plus or minus 10 percent)
Contrasting inclusions:
- Phiferson soils—0 to 7 percent
- Rock outcrop—0 to 4 percent
- Vetal soils—0 to 9 percent

### *Typical Profile*

**Busher**

*Surface layer:*
0 to 8 inches—dark brown, very friable loamy very fine sand

*Subsurface layer:*
8 to 18 inches—brown, very friable loamy very fine sand

*Subsoil:*
18 to 28 inches—pale brown, very friable, calcareous loamy very fine sand

*Substratum:*
28 to 42 inches—pale brown, calcareous loamy very fine sand that has 10 percent gravel-sized sandstone fragments, by volume
42 to 60 inches—light gray, calcareous sandstone

**Tassel**

*Surface layer:*
0 to 6 inches—grayish brown, calcareous loamy very fine sand

*Substratum:*
6 to 12 inches—pale brown, calcareous loamy very fine sand that has 12 percent gravel-sized sandstone fragments, by volume

12 to 60 inches—light gray, calcareous sandstone

## Soil Properties and Qualities

### Busher

*Depth to paralithic contact:* 40 to 60 inches (mainly 50 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 42 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (6.84 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Tassel

*Depth to paralithic contact:* 6 to 20 inches (mainly 10 inches)
*Potential rooting depth:* 10 to 20 inches (mainly 12 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.04 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

## Inclusions

*Contrasting inclusions:*
- Phiferson soils, which have calcareous sandstone bedrock at a depth of 20 to 40 inches and are on shoulders and summits on the higher parts of the landscape
- Outcrops of calcareous sandstone on the higher parts of the landscape
- Vetal soils, which have a dark surface soil that is more than 20 inches thick and are in swales on the lower parts of the landscape

*Inclusions similar to the Busher soil:*
- Some areas where the surface layer and subsoil are very fine sandy loam or fine sandy loam
- Some areas where the dark material making up the surface layer is less than 7 inches thick
- A few areas where the underlying material is loamy fine sand

*Inclusions similar to the Tassel soil:*
- Some areas where the surface layer is fine sandy loam or very fine sandy loam

## Use and Management

### Cultivated crops

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.

### Rangeland and hay

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

### Windbreaks

*Busher*

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

*Tassel*

*Suitability:* Generally not suited
- This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

### Dwellings

*Busher*

*Management concerns:* A moderate limitation because of the depth to calcareous sandstone
*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

*Tassel*

*Management concerns:* A moderate limitation on sites for dwellings without basements and a severe limitation on sites for dwellings with basements because of the depth to calcareous sandstone
*Management measures:*
- The soft bedrock generally can be easily excavated on

sites for dwellings with or without basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Suitability:* Busher—suited; Tassel—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Busher*

*Management concerns:* A moderate limitation because of the depth to calcareous sandstone
*Management measures:*
- Suitable fill material can raise the absorption field a sufficient distance above the calcareous sandstone bedrock.

### *Interpretive Groups*

*Land capability classification:* Busher—IVe-5, dryland, and IVe-10, irrigated; Tassel—VIs-4, dryland
*Windbreak suitability group:* Busher—5; Tassel—10
*Range site:* Busher—Sandy; Tassel—Shallow Limy
*Irrigation design group:* Busher—10

## BxE—Busher-Tassel complex, 6 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Busher—back slopes and foot slopes; Tassel—summits and shoulders
*Slope range:* Busher—6 to 20 percent (mainly 14 percent); Tassel—6 to 20 percent (mainly 15 percent)
*Major use:* Rangeland

### *Composition*

Busher soil and similar soils: 48 percent (plus or minus 10 percent)
Tassel soil and similar soils: 32 percent (plus or minus 10 percent)
Contrasting inclusions:
- Phiferson soils—0 to 6 percent
- Rock outcrops—0 to 5 percent
- Valent soils—0 to 4 percent
- Oglala soils—0 to 2 percent
- Vetal soils—0 to 3 percent

### *Typical Profile*

**Busher**

*Surface layer:*
0 to 10 inches—dark grayish brown, very friable loamy very fine sand

*Subsoil:*
10 to 20 inches—brown, very friable loamy very fine sand

*Substratum:*
20 to 29 inches—pale brown loamy very fine sand
29 to 45 inches—very pale brown loamy very fine sand that has 8 percent gravel-sized sandstone fragments, by volume
45 to 60 inches—white, calcareous sandstone

**Tassel**

*Surface layer:*
0 to 6 inches—brown, very friable, calcareous loamy very fine sand

*Transitional layer:*
6 to 12 inches—very pale brown, soft, calcareous loamy very fine sand

*Substratum:*
12 to 18 inches—very pale brown, calcareous loamy very fine sand that has 10 percent sandstone gravel, by volume
18 to 60 inches—very pale brown, calcareous sandstone

### *Soil Properties and Qualities*

**Busher**

*Depth to paralithic contact:* 40 to 60 inches (mainly 50 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 50 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.32 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 10 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 10 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.0 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Phiferson soils, which have calcareous sandstone at a depth of 20 to 40 inches and are higher on the landscape than the Busher soil
- Rock outcrops, which are on narrow ridgetops and sharp slope breaks and are barren areas of calcareous sandstone
- Oglala soils, which have more silt and less sand than the Busher soil and are on similar landscapes
- Valent soils, which contain more sand than the Busher and Tassel soils and are on dunes
- Vetal soils, which have a dark surface soil that is more than 20 inches thick and are in swales and on the foot slopes of hillslopes

*Inclusions similar to the Busher soil:*
- Some areas where the soil is very fine sandy loam throughout
- Some areas where the surface layer is very fine sandy loam and in places is lighter colored

*Inclusions similar to the Tassel soil:*
- Some areas where the depth to sandstone is less than 6 inches
- Some areas where the surface layer is loamy fine sand or very fine sand

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Busher*

*Management measures:*
- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the surface as possible.

*Tassel*

*Suitability:* Generally not suited
- This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Busher*

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

*Tassel*

*Management concerns:* Moderate limitations on sites for dwellings without basements because of the slope and the depth to calcareous sandstone; a severe limitation on sites for dwellings with basements because of the depth to calcareous sandstone
*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.
- Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock should be graded.

**Septic tank absorption fields**

*Suitability:* Busher—suited only in areas where the slope is less than 15 percent; Tassel—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Busher*

*Management concerns:* Moderate limitations because of the depth to calcareous sandstone and the slope
*Management measures:*
- Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.
- Fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### *Interpretive Groups*

*Land capability classification:* Busher—VIe-5, dryland; Tassel—VIs-4, dryland
*Windbreak suitability group:* Busher—7; Tassel—10
*Range site:* Busher—Sandy; Tassel—Shallow Limy

## Cr—Craft loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### Composition

Craft soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 10 percent
Lohmiller soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—brown, friable, calcareous loam

*Substratum:*
6 to 35 inches—pale brown, friable, calcareous loam stratified with clay loam and fine sandy loam
35 to 60 inches—pale brown, friable, calcareous loam stratified with fine sandy loam and very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Depth to a seasonal high water table:* More than 6 feet
*Available water capacity:* High (11.16 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
• Glenberg soils, which contain more sand than the Craft soil and are higher on the landscape
• Lohmiller soils, which contain more clay than the Craft soil and are lower on the landscape
• Some areas that have meandering stream channels

*Similar inclusions:*
• Soils that have a surface layer of fine sandy loam, clay loam, or clay

### Use and Management

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the crops and thus reduce their vigor and impair their growth.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.
• The species suitable for planting are those that can tolerate occasional wetness.

**Dwellings**

*Management concerns:* A severe limitation because of the rare flooding
*Management measures:*
• Dwellings should be constructed on well compacted, elevated fill material, which helps to prevent the damage caused by floodwater.

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the rare flooding and the moderate permeability
*Management measures:*
• The hazard of rare flooding should be considered if this soil is used as a site for septic tank absorption fields.
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIc-1; irrigated—I-6
*Windbreak suitability group:* 1L
*Range site:* Silty Lowland
*Irrigation design group:* 6

## Cs—Craft loam, 0 to 2 percent slopes, occasionally flooded

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### Composition

Craft soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 10 percent
Lohmiller soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—light yellowish brown, friable, calcareous loam

*Substratum:*
4 to 18 inches—light yellowish brown, calcareous loam stratified with silty clay loam
18 to 30 inches—light yellowish brown, calcareous loam stratified with fine sandy loam
30 to 60 inches—light yellowish brown, calcareous loam stratified with clay loam and fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.16 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Glenberg soils, which contain more sand than the Craft soil and are higher on the landscape
- Lohmiller soils, which contain more clay than the Craft soil are lower on the landscape
- Some areas that are characterized by meandering stream channels

*Similar inclusions:*
- Soils that have a surface layer of fine sandy loam
- Soils that have a surface layer of clay or silty clay

### Use and Management

**Cultivated crops**

*Management measures:*
- Furrow, border, and sprinkler irrigation systems can be used.
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.

**Windbreaks**

*Management measures:*
- Only those species that can tolerate a high content of calcium should be selected for planting.
- The species suitable for planting are those that can tolerate occasional wetness.

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the occasional flooding.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the occasional flooding.

### Interpretive Groups

*Land capability classification:* Dryland—IIw-3; irrigated—IIw-6
*Windbreak suitability group:* 1L
*Range site:* Silty Overflow
*Irrigation design group:* 6

## Ct—Craft loam, channeled, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains
*Major uses:* Rangeland and wildlife habitat

### Composition

Craft soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 5 percent
Lohmiller soils—0 to 5 percent
Occasionally flooded areas that have no meandering stream channels—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—pale brown, very friable, calcareous loam

*Substratum:*
6 to 60 inches—very pale brown, very friable, calcareous loam stratified with silt loam, silty clay loam, and very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.16 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Glenberg soils, which contain more sand than the Craft soil and are higher on the landscape
- Lohmiller soils, which contain more clay than the Craft soil and are lower on the landscape
- Some small areas that are not dissected by stream channels

*Similar inclusions:*
- Soils that have a surface layer of fine sandy loam
- Soils that have a surface layer of clay

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
- This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the frequent flooding.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the frequent flooding.

### Interpretive Groups

*Land capability classification:* Dryland—VIw-7
*Windbreak suitability group:* 10
*Range site:* Silty Overflow

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

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 3 percent (mainly 1 percent)
*Major use:* Rangeland

### Composition

Draknab soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 5 percent
Soils that contain more than 15 percent gravel, by volume—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—brown, very friable, calcareous loamy fine sand

*Substratum:*
5 to 29 inches—pale brown, calcareous loamy sand stratified with fine sandy loam
29 to 60 inches—pale brown, calcareous coarse sand stratified with loamy fine sand and fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (5.4 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
• Glenberg soils, which contain more silt and less sand than the Draknab soil and are in about the same landscape positions
• Soils that have more than 15 percent gravel, by volume, and are in landscape positions similar to those of the Draknab soil

*Similar inclusions:*
• Soils that have a surface layer of fine sandy loam or very fine sandy loam

### Use and Management

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.

**Dwellings**

*Management concerns:* A severe limitation because of the rare flooding
*Management measures:*
• Dwellings should be constructed on well compacted, elevated fill material, which helps to prevent the damage caused by floodwater.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Protection from rare flooding is needed on this soil.
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-11
*Windbreak suitability group:* 7
*Range site:* Sandy Lowland
*Irrigation design group:* 11

## EpF—Epping silt loam, 3 to 30 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Slope range:* 3 to 30 percent (mainly 17 percent)
*Major use:* Rangeland

### Composition

Epping soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Badlands—0 to 5 percent
Mitchell soils—0 to 5 percent
Thirtynine soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—pale brown, very friable, calcareous silt loam

*Transitional layer:*
6 to 10 inches—pale brown, very friable, calcareous silt loam that has 5 percent gravel-sized fragments of calcareous siltstone, by volume

*Substratum:*
10 to 15 inches—very pale brown, calcareous silt loam that has 10 percent gravel-sized fragments of calcareous siltstone, by volume
15 to 60 inches—white, calcareous siltstone

### Soil Properties and Qualities

*Depth to paralithic contact:* 10 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 10 to 20 inches
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.09 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous siltstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Very severe
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Badlands, which are barren, eroding areas that generally are higher on the landscape than the Epping soil
- Mitchell soils, which are deep and are in areas below the Epping soil
- Thirtynine soils, which are deep, have a dark surface layer, and are in areas below the Epping soil
- Some areas where siltstone bedrock is within a depth of 6 inches

*Similar inclusions:*
- Areas where the surface layer is loam or silty clay loam
- Areas where lime is leached below a depth of 6 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
- This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Management concerns:* Severe limitations because of the slope and the depth to bedrock
*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.
- Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock should be graded.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the slope.

### Interpretive Groups

*Land capability classification:* Dryland—VIs-4
*Windbreak suitability group:* 10
*Range site:* Shallow Limy

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

### Setting

*Landform:* Hillslopes
*Position on the landform:* Epping—summits and shoulders; Badland—back slopes
*Slope range:* Epping—3 to 50 percent (mainly 20 percent); Badland—9 to 50 percent (mainly 40 percent)
*Major uses:* Rangeland and wildlife habitat

### Composition

Epping soil and similar soils: 50 percent (plus or minus 10 percent)
Badland: 35 percent (plus or minus 10 percent)
Contrasting inclusions:
Mitchell soils—0 to 5 percent
Orella soils—0 to 5 percent
Thirtynine soils—0 to 5 percent

### Typical Profile

**Epping soil**

*Surface layer:*
0 to 4 inches—brown, very friable, calcareous silt loam

*Transitional layer:*
4 to 9 inches—pale brown, very friable, calcareous silt loam

*Substratum:*
9 to 18 inches—pale brown, calcareous silt loam that has 10 percent gravel-sized fragments of siltstone, by volume
18 to 60 inches—white, calcareous siltstone

### Characteristics of the Badland

- Badland consists of deeply dissected, eroded exposures of siltstone. It supports little or no vegetation. It generally is highly erodible. The terrain is very steep and rough.

### Soil Properties and Qualities

**Epping**

*Depth to paralithic contact:* 10 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 10 to 20 inches (mainly 15 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.66 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous siltstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

**Badland**

*Available water capacity:* Very low (less than 0.5 inch)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Siltstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Very severe
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Thirtynine soils, which have an increase in content of clay in the subsoil and have siltstone below a depth of 40 inches
- Mitchell soils, which are deep and are on colluvial foot slopes below areas of the Epping soil and the Badland
- Orella soils, which contain more clay and salts than the Epping soil and are below areas of the Epping soil and the Badland

*Inclusions similar to the Epping soil:*
- Areas where the surface layer is very fine sandy loam or silty clay loam
- Areas where carbonates are leached below a depth of 10 inches

*Inclusions similar to Badland:*
- Areas where the depth to siltstone or shale is less than 6 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the slope.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the slope.

### Interpretive Groups

*Land capability classification:* Epping—VIs-4, dryland; Badland—VIIIs-8, dryland
*Windbreak suitability group:* Epping—10; Badland—10
*Range site:* Epping—Shallow Limy; Badland—none

## Fu—Fluvaquents, sandy, 0 to 1 percent slopes

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major uses:* Wildlife habitat and recreation

### Composition

Fluvaquents, sandy, and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bigwinder soils—0 to 5 percent
Las Animas soils—0 to 5 percent

### Typical Profile

*Surface layer:*
2 inches to 0—dark grayish brown, partially decomposed organic matter

*Subsurface layer:*
0 to 4 inches—gray, very friable loamy sand

*Substratum:*
4 to 60 inches—light brownish gray fine sand stratified with loamy fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Very low (0 to 0.5 percent)

*Drainage class:* Very poorly drained
*Seasonal high water table:* 2 feet above to 1 foot below the surface
*Available water capacity:* Low (4.92 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Ponded
*Flooding:* Frequent
*Ponding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Slight

### Inclusions

*Contrasting inclusions:*
• Bigwinder and Las Animas soils, which are better drained than the Fluvaquents, are higher on the landscape, and contain less sand and more silt

*Similar inclusions:*
• Some areas where the surface layer is silt loam or silty clay loam

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
• Excessive wetness limits the choice of suitable pasture grasses and legumes.
• After the ground is frozen, livestock can graze without damaging the meadows. The livestock should be removed in spring, before the ground thaws.

**Windbreaks**

*Suitability:* Generally not suited
• These soils have one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

### Interpretive Groups

*Land capability classification:* Dryland—VIIIw-7
*Windbreak suitability group:* 10
*Range site:* None

## Go—Glenberg fine sandy loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### Composition

Glenberg soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Bankard soils—0 to 5 percent
Channeled Glenberg soils—0 to 5 percent
Craft soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—brown, very friable, calcareous fine sandy loam

*Substratum:*
5 to 60 inches—pale brown, calcareous fine sandy loam stratified with thin layers of very fine sandy loam, silt loam, and gravelly sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.24 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
• Bankard soils, which contain more sand throughout than the Glenberg soil and are lower on the landscape
• Craft soils, which contain more clay in the surface layer and subsoil than the Glenberg soil and are in similar or slightly higher landscape positions

• Channeled Glenberg soils, which are subject to flooding and are commonly cut by deep, meandering channels

*Similar inclusions:*
• Soils that have a surface layer of very fine sandy loam or loam
• Soils that are leached of lime below a depth of 6 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Furrow, border, and sprinkler irrigation systems can be used.
• Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or other vegetation between the tree rows are needed to control soil blowing.
• Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Management concerns:* A severe limitation because of the rare flooding
*Management measures:*
• Dwellings should be constructed on elevated, well compacted fill material, which helps to prevent the damage caused by floodwater.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of the rare flooding
*Management measures:*
• Protection from rare flooding is needed on this soil. The absorption fields function well if they are protected from floodwater.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8
*Windbreak suitability group:* 1L
*Range site:* Sandy Lowland
*Irrigation design group:* 8

## Gp—Glenberg fine sandy loam, channeled, 0 to 2 percent slopes

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Rangeland and wildlife habitat

### *Composition*

Glenberg soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bankard soils—0 to 5 percent
Craft soils—0 to 10 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—pale brown, very friable fine sandy loam

*Substratum:*
6 to 60 inches—pale brown, very friable, calcareous fine sandy loam stratified with very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.24 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Bankard soils, which contain more sand than the Glenberg soil and are on similar landscapes
• Craft soils, which contain more clay and silt than the Glenberg soil and are on similar landscapes

*Similar inclusions:*
• Some areas where the surface layer is very fine sandy loam or loamy fine sand

• Some areas where gravelly sand is at a depth of more than 40 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

### Interpretive Groups

*Land capability classification:* Dryland—VIw-7
*Windbreak suitability group:* 10
*Range site:* Sandy Lowland

## HsC—Hisle-Slickspots complex, 0 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Hisle—shoulders, back slopes, and foot slopes; Slickspots—toe slopes
*Slope range:* Hisle—0 to 6 percent (mainly 2 percent); Slickspots—0 to 6 percent (mainly 2 percent)
*Major use:* Rangeland

### Composition

Hisle soil and similar soils: 65 percent (plus or minus 10 percent)
Slickspots—25 percent (plus or minus 10 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Pierre soils—0 to 5 percent

### Typical Profile

**Hisle**

*Surface layer:*
0 to 2 inches—grayish brown, friable loam

*Subsoil:*
2 to 5 inches—light olive brown, very firm, calcareous clay
5 to 11 inches—olive, very firm, calcareous clay
11 to 18 inches—olive gray, very firm, calcareous clay
18 to 27 inches—pale olive, very firm, calcareous clay

*Substratum:*
27 to 60 inches—light yellowish brown, bedded clay shale

**Slickspots**

• The soil material is dense, massive clay to a depth of 60 inches. The surface is crusted and nearly impervious to water. Accumulations of salts are visible at or near the surface. These areas support little or no vegetation.

### Soil Properties and Qualities

**Hisle**

*Depth to paralithic contact:* 20 to 40 inches (mainly 25 inches)
*Potential rooting depth:* 20 to 40 inches (mainly 25 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.51 inches)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Slight
*Distinctive property:* A high content of salts and sodium

### Inclusions

*Contrasting inclusions:*
• Arvada soils, which are deep and are on the lower parts of landscape
• Pierre soils, which are not high in content of sodium and salts and are on landscapes similar to those of the Hisle soil and the Slickspots

*Inclusions similar to the Hisle soil:*
• Soils with a surface layer of silt loam
• Soils with a surface layer of fine sandy loam
• Soils that have shale at a depth of 40 to 60 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Careful management is needed in saline-alkaline areas, which support little or no vegetation and are subject to severe soil blowing during dry periods.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the very slow permeability.

### Interpretive Groups

*Land capability classification:* Hisle—VIs-1, dryland; Slickspots—VIIIs
*Windbreak suitability group:* Hisle—10; Slickspots—none
*Range site:* Hisle—Panspots; Slickspots—none

## In—Interior silty clay, channeled, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains (fig. 9)
*Major use:* Rangeland

### Composition

Interior soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 5 percent
Craft soils—0 to 5 percent
Lohmiller soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—light gray, calcareous, strongly alkaline silty clay

*Transitional layer:*
6 to 13 inches—light gray, calcareous, strongly alkaline silty clay loam

*Substratum:*
13 to 60 inches—light gray, stratified, calcareous, strongly alkaline silt loam stratified with very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.76 inches)
*Permeability:* Moderate (0.6 to 2.0 inches per hour)
*Parent material:* Silty alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate
*Distinctive property:* A high content of salts and sodium

### Inclusions

*Contrasting inclusions:*
• Glenberg soils, which are not affected by sodium, contain more sand and less clay than the Interior soil, and are on similar landscapes
• Craft soils, which are not affected by salts and alkali, contain more sand than the Interior soil, and are on similar landscapes
• Lohmiller soils, which are not affected by salts and alkali, contain more clay than the Interior soil, and are on similar landscapes

*Similar inclusions:*
• Soils that have a surface layer of silty clay loam
• Soils that have a surface layer of silt loam
• Soils that have strata of sand and gravel below a depth of 40 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the

**Figure 9.—A typical area of Interior silty clay, channeled, 0 to 2 percent slopes. Orella-Badland complex, 3 to 50 percent slopes, is in the background.**

grasses and thus reduce their vigor and impair their growth.
• If an area is reseeded, the species selected for planting should be those that are suited to a saline or alkali soil.

### Windbreaks

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

### Dwellings

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

### Septic tank absorption fields

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

## *Interpretive Groups*

*Land capability classification:* Dryland—VIw-7

*Windbreak suitability group:* 10
*Range site:* Saline Lowland

## JmB—Jayem loamy very fine sand, 0 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits
*Slope range:* 0 to 3 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Jayem soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Satanta soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—dark brown, very friable loamy very fine sand

*Subsurface layer:*
8 to 18 inches—brown, very friable loamy very fine sand

*Subsoil:*
18 to 32 inches—brown, very friable loamy very fine sand

*Substratum:*
32 to 60 inches—pale brown loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which have sandstone at a depth of 40 to 60 inches and are higher on the landscape than the Jayem soil
- Satanta soils, which contain more clay in the subsoil than the Jayem soil and are in similar landscape positions
- Valent soils, which have a light colored surface layer, contain more sand than the Jayem soil, and are in similar landscape positions

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam or fine sandy loam
- Soils that have carbonates within a depth of 40 inches
- Soils that have a dark surface layer that is more than 20 inches thick

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used (fig. 10).

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-5; irrigated—IIIe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

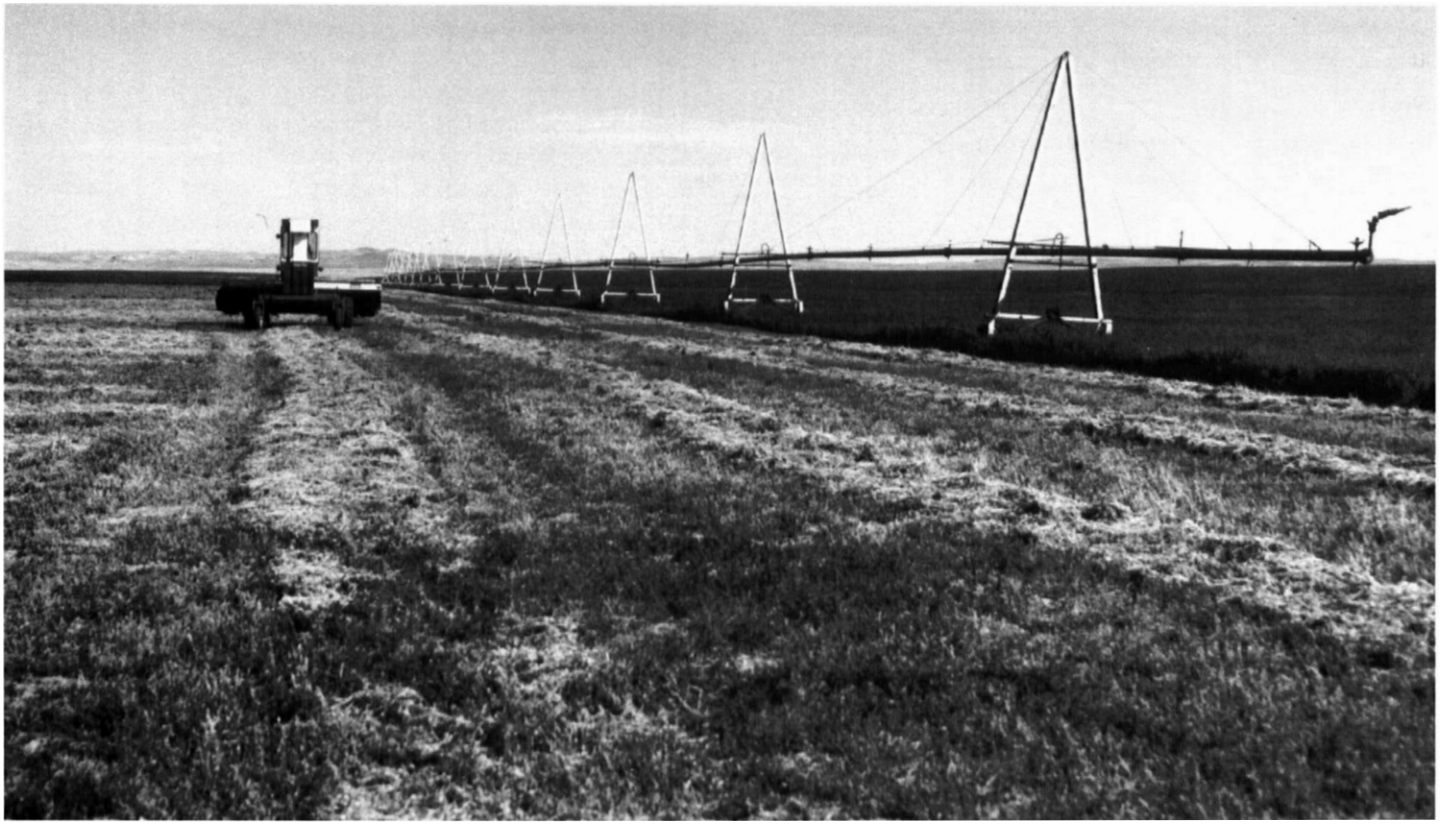

**Figure 10.—Irrigated alfalfa in an area of Jayem loamy very fine sand, 0 to 3 percent slopes.**

## JmC—Jayem loamy very fine sand, 3 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major use:* Rangeland

### *Composition*

Jayem soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Satanta soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable loamy very fine sand

*Subsurface layer:*
8 to 17 inches—brown, very friable loamy very fine sand

*Subsoil:*
17 to 30 inches—brown, very friable loamy very fine sand

*Substratum:*
30 to 60 inches—pale brown loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which have sandstone at a depth of 40 to 60 inches and are higher on the landscape than the Jayem soil
- Satanta soils, which contain more clay in the subsoil than the Jayem soil and are in similar landscape positions
- Valent soils, which have a light colored surface layer,

contain more sand than the Jayem soil, and are in similar landscape positions

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam or fine sandy loam
- Soils that have carbonates within a depth of 40 inches
- Soils that have a dark surface layer that is more than 20 inches thick

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## JmD—Jayem loamy very fine sand, 6 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Slope range:* 6 to 9 percent (mainly 8 percent)
*Major use:* Rangeland

### *Composition*

Jayem soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 10 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 10 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
10 to 20 inches—brown, very friable loamy very fine sand
20 to 26 inches—pale brown, very friable loamy very fine sand

*Substratum:*
26 to 60 inches—pale brown loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which have sandstone at a depth of 40 to 60 inches and are higher on the landscape than the Jayem soil
- Valent soils, which contain more sand than the Jayem soil and are on similar landscapes

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam or fine sandy loam

• Soils that have carbonates within a depth of 40 inches
• Soils that have a dark surface layer that is more than 20 inches thick

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## KeB—Keith loam, 1 to 3 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### Composition

Keith soil and similar soils: 85 percent (plus or minus 5 percent)

Contrasting inclusions:
Oglala soils—0 to 5 percent
Satanta soils—0 to 5 percent
Vetal soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, friable loam

*Subsoil:*
8 to 18 inches—brown, firm silty clay loam
18 to 26 inches—pale brown, firm silty clay loam
26 to 36 inches—pale brown, friable silt loam

*Substratum:*
36 to 60 inches—very pale brown, calcareous silt loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.68 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loess
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
• Oglala soils, which contain less clay than the Keith soil, have calcareous sandstone at a depth of 40 to 60 inches, and are on knobs above the Keith soil
• Satanta soils, which contain more sand than the Keith soil and are in similar landscape positions
• Vetal soils, which have more than 20 inches of dark surface soil, contain more sand than the Keith soil, and are in shallow depressions on the lower parts of the landscape

*Similar inclusions:*
• Soils with a surface layer of fine sandy loam
• Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Terraces, contour farming, and grassed waterways help to control water erosion.

• A sprinkler system is the best method of irrigation because land leveling would be required if surface irrigation methods were used.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIe-1; irrigated—IIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## KeC—Keith loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Keith soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Oglala soils—0 to 5 percent
Satanta soils—0 to 5 percent
Vetal soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—very dark grayish brown, very friable loam

*Subsurface layer:*
7 to 14 inches—dark grayish brown, friable loam

*Subsoil:*
14 to 20 inches—grayish brown silty clay loam
20 to 32 inches—pale brown silty clay loam
32 to 46 inches—very pale brown, calcareous silt loam

*Substratum:*
46 to 60 inches—very pale brown, calcareous silt loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.62 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loess
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Oglala soils, which contain less clay than the Keith soil, have calcareous sandstone at a depth of 40 to 60 inches, and are on knobs above the Keith soil
• Satanta soils, which contain more sand than the Keith soil and are in similar landscape positions
• Vetal soils, which have a dark surface layer that is more than 20 inches thick, contain more sand than the Keith soil, and are in shallow depressions on the lower parts of the landscape

*Similar inclusions:*
• Soils with a surface layer of fine sandy loam
• Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
• Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause

poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-1; irrigated—IIIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## Ky—Kyle silty clay, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 1 percent)
*Major uses:* Rangeland and hayland

### *Composition*

Kyle soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 10 percent
Bufton soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, extremely firm silty clay

*Subsoil:*
4 to 28 inches—light brownish gray, extremely firm clay
28 to 37 inches—light olive gray, extremely firm, calcareous clay

*Substratum:*
37 to 60 inches—light olive gray, calcareous clay

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (6.88 inches)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Clayey sediments weathered from shale
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Arvada soils, which contain less clay than the Kyle soil, are affected by salts and alkali, and are in landscape positions similar to those of the Kyle soil
• Bufton soils, which contain less clay than the Kyle soil and are in similar landscape positions

*Similar inclusions:*
• Soils with a surface layer of clay
• Soils that are stratified below a depth of 40 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow and border surface irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and

backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the very slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVs-2; irrigated—IVs-1
*Windbreak suitability group:* 4C
*Range site:* Clayey
*Irrigation design group:* 1

## KyC—Kyle silty clay, 1 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Broad summits and foot slopes
*Slope range:* 1 to 6 percent (mainly 3 percent)
*Major use:* Rangeland

### *Composition*

Kyle soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Pierre soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, very firm, calcareous silty clay

*Subsoil:*
4 to 20 inches—grayish brown, very firm, calcareous clay
20 to 40 inches—grayish brown, very firm, calcareous clay
40 to 49 inches—grayish brown, very firm, calcareous clay

*Substratum:*
49 to 60 inches—dark grayish brown, calcareous clay

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Depth to a seasonal high water table:* More than 6 feet
*Available water capacity:* Moderate (6.80 inches)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Clayey sediments weathered from shale
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Bufton soils, which contain less clay than the Kyle soil and are in similar landscape positions
• Pierre soils, which are 20 to 40 inches deep over shale and are higher on the landscape than the Kyle soil

*Similar inclusions:*
• Soils with a surface layer of silty clay loam or clay

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Terraces, contour farming, and grassed waterways help to control water erosion.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
• Planting on the contour helps to control water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the very slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-4

*Windbreak suitability group:* 4C
*Range site:* Clayey

## La—Las Animas fine sandy loam, 0 to 2 percent slopes, occasionally flooded

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Hayland and rangeland

### Composition

Las Animas soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bigwinder soils—0 to 5 percent
Lisco soils—0 to 10 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—grayish brown, very friable fine sandy loam

*Substratum:*
8 to 39 inches—light brownish gray, calcareous loamy very fine sand stratified with very fine sandy loam
39 to 60 inches—light brownish gray, calcareous loamy very fine sand stratified with very fine sandy loam and loamy fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 36 inches
*Available water capacity:* Moderate (6.87 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Bigwinder soils, which are poorly drained and are in low areas
- Lisco soils, which are affected by salts and alkalinity and are in landscape positions similar to those of the Las Animas soil

*Similar inclusions:*
- Areas where the surface layer is very fine sandy loam or loamy very fine sand
- Some areas where the soil has layers of gravel below a depth of 40 inches

### Use and Management

**Cultivated crops**

*Management measures:*
- Furrow, border, and sprinkler irrigation systems can be used.
- Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
- Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth. Also, grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
- Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.

**Windbreaks**

*Management measures:*
- The species suitable for planting are those that can tolerate occasional wetness.
- Hand planting may be necessary in spring because of the wetness.

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the occasional flooding and the wetness.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the occasional flooding.

### Interpretive Groups

*Land capability classification:* Dryland—IIIw-6; irrigated—IIIw-8
*Windbreak suitability group:* 2S
*Range site:* Subirrigated
*Irrigation design group:* 8

## Lb—Las Animas fine sandy loam, channeled, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Rangeland and wildlife habitat

### Composition

Las Animas soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bigwinder soils—0 to 10 percent
Lisco soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—grayish brown, very friable, calcareous fine sandy loam

*Substratum:*
4 to 30 inches—light brownish gray, calcareous fine sandy loam stratified with loamy fine sand and very fine sandy loam
30 to 60 inches—light brownish gray, calcareous loamy fine sand stratified with fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 42 inches
*Available water capacity:* Moderate (6.25 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Bigwinder soils, which are poorly drained and are in low areas
- Lisco soils, which are affected by salts and alkalinity and are in landscape positions similar to those of the Las Animas soil

*Similar inclusions:*
- Areas where the surface layer is very fine sandy loam or loamy very fine sand
- Some areas where the soil has layers of gravel below a depth of 40 inches

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth and can deplete the protective plant cover, resulting in severe soil blowing.
- Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.

**Windbreaks**

*Suitability:* Generally not suited
- A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the frequent flooding and the wetness.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the frequent flooding.

### Interpretive Groups

*Land capability classification:* Dryland—VIw-7
*Windbreak suitability group:* 10
*Range site:* Subirrigated

## Lc—Las Animas-Lisco complex, 0 to 2 percent slopes, occasionally flooded

### Setting

*Landform:* Flood plains
*Slope range:* Las Animas and Lisco—0 to 2 percent (mainly 1 percent)
*Major uses:* Rangeland and hayland

### Composition

Las Animas soil and similar soils: 60 percent (plus or minus 10 percent)
Lisco soil and similar soils: 25 percent (plus or minus 10 percent)

Contrasting inclusions:
Bigwinder soils—0 to 5 percent
Channeled Las Animas soils—0 to 5 percent
Wildhorse soils—0 to 5 percent

### *Typical Profile*

**Las Animas**

*Surface layer:*
0 to 6 inches—light brownish gray, very friable, calcareous very fine sandy loam

*Transitional layer:*
6 to 12 inches—light brownish gray, calcareous very fine sandy loam

*Substratum:*
12 to 60 inches—light gray, calcareous very fine sandy loam stratified with loam and loamy very fine sand

**Lisco**

*Surface layer:*
0 to 6 inches—light brownish gray, very friable, calcareous very fine sandy loam

*Subsoil:*
6 to 19 inches—light brownish gray, very friable, calcareous loamy very fine sand
19 to 25 inches—light brownish gray, very friable, calcareous loamy very fine sand

*Substratum:*
25 to 38 inches—light gray, calcareous loamy very fine sand
38 to 60 inches—gray, calcareous loam stratified with very fine sandy loam

### *Soil Properties and Qualities*

**Las Animas**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 36 inches
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

**Lisco**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 42 inches
*Available water capacity:* High (10.00 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe
*Distinctive property:* A high content of salts and sodium

### *Inclusions*

*Contrasting inclusions:*
- Bigwinder soils, which are poorly drained and are lower on the landscape than the Las Animas and Lisco soils
- Channeled Las Animas soils, which are dissected by meandering stream channels and are frequently flooded
- Wildhorse soils, which contain more sand than the Las Animas and Lisco soils, are affected by salts and sodium, and are on the higher parts of landscape

*Inclusions similar to the Las Animas soil:*
- Some areas where the surface layer is loamy very fine sand or fine sandy loam
- Some areas where gravelly material is below a depth of 40 inches

*Inclusions similar to the Lisco soil:*
- Some areas where the surface layer is loamy very fine sand or fine sandy loam
- Some areas where gravelly sand is at a depth of more than 40 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Delayed planting may be needed because of the high water table.
- Furrow, border, and sprinkler irrigation systems can be used.
- Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
- Reed canarygrass and creeping foxtail can be grown on these somewhat poorly drained soils.
- Tall wheatgrass and switchgrass can be grown in the alkali-saline areas.
- Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth. Also, grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
- Large meadows can be divided into three sections and

the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.

**Windbreaks**

*Suitability:* Las Animas—suited; Lisco—generally unsuited
• The Lisco soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify areas that are suitable for planting.
*Management measures:*
• The species suitable for planting are those that can tolerate occasional wetness.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the occasional flooding and the wetness.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the occasional flooding.

### *Interpretive Groups*

*Land capability classification:* Las Animas—IIIw-6, dryland, and IIIw-8, irrigated; Lisco—VIs-1, dryland
*Windbreak suitability group:* Las Animas—2S; Lisco—10
*Range site:* Las Animas—Subirrigated; Lisco—Saline Subirrigated
*Irrigation design group:* Las Animas—8

## Ld—Lisco very fine sandy loam, 0 to 2 percent slopes, occasionally flooded

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Rangeland and hayland

### *Composition*

Lisco soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bigwinder soils—0 to 5 percent
Las Animas soils—0 to 5 percent
Wildhorse soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, very friable very fine sandy loam

*Subsoil:*
4 to 8 inches—grayish brown, very friable, calcareous very fine sandy loam
8 to 22 inches—light brownish gray, very friable, calcareous very fine sandy loam

*Substratum:*
22 to 27 inches—light brownish gray, calcareous very fine sandy loam stratified with loamy very fine sand and loam
27 to 50 inches—light gray, calcareous very fine sandy loam stratified with loamy fine sand
50 to 60 inches—light brownish gray, calcareous loamy fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 42 inches
*Available water capacity:* Moderate (8.88 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe
*Distinctive property:* A high content of salts and sodium

### *Inclusions*

*Contrasting inclusions:*
• Bigwinder soils, which are poorly drained, are not affected by salts and alkalinity, and are lower on the landscape than the Lisco soil
• Las Animas soils, which are not affected by salts and alkalinity and are in landscape positions similar to those of the Lisco soil
• Wildhorse soils, which contain more sand and less silt than the Lisco soil and are in similar landscape positions

*Similar inclusions:*
• Some areas where the surface layer is loamy very fine sand or loamy fine sand
• Some areas where gravelly layers are below a depth of 40 inches

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Tall wheatgrass and switchgrass can be grown on this alkali-saline soil.
• Overgrazing and grazing when the soil is wet should be

avoided because they can cause compaction and poor tilth and can deplete the protective plant cover, resulting in severe soil blowing. Also, grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.

**Windbreaks**

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIs-1
*Windbreak suitability group:* 10
*Range site:* Saline Subirrigated

## Lh—Lohmiller silty clay loam, 0 to 2 percent slopes

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major use:* Hayland

### *Composition*

Lohmiller soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Craft soils—0 to 5 percent
Glenberg soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 5 inches—brown, firm, calcareous silty clay loam

*Subsurface layer:*
5 to 9 inches—pale brown, firm, calcareous silty clay loam

*Substratum:*
9 to 60 inches—pale brown, calcareous silty clay loam stratified with thin lenses of silty clay, silt loam, and loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.76 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Clayey alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Craft soils, which contain less clay than the Lohmiller soil and are on the same landscapes
• Glenberg soils, which have less clay and more sand than the Lohmiller soil and are on similar landscapes

*Similar inclusions:*
• Channeled Lohmiller soils, which are dissected by meandering stream channels and are frequently flooded
• Soils that have a surface layer of silt loam
• Soils that have a surface layer of silty clay

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface conserves soil moisture and helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.
• The rate at which irrigation water is applied should be adjusted to the intake rate of the soil.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Management concerns:* Severe limitations because of the flooding and the shrink-swell potential
*Management measures:*
• Dwellings should be constructed on well compacted fill material, which helps to prevent the damage caused by floodwater.
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIc-1; irrigated—IIIe-3
*Windbreak suitability group:* 1L
*Range site:* Clayey Overflow
*Irrigation design group:* 3

## Lo—Lohmiller silty clay loam, channeled, 0 to 2 percent slopes

### *Setting*

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 0 percent)
*Major use:* Rangeland

### *Composition*

Lohmiller soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 5 percent
Craft soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—grayish brown, friable, calcareous silty clay loam

*Substratum:*
6 to 10 inches—pale brown, firm, calcareous silty clay loam
10 to 60 inches—light brownish gray, calcareous silty clay loam stratified with loam and clay loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.76 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Clayey alluvium
*Surface runoff:* Slow
*Flooding:* Frequent
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Channeled Glenberg soils, which contain more sand and less clay than the Lohmiller soil and are on similar landscapes
• Channeled Craft soils, which contain more silt and sand and less clay than the Lohmiller soil and are on similar landscapes

*Similar inclusions:*
• Soils that have a surface layer of silty clay
• Soils that have accumulations of salts

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Management considerations include the deposition of sediment by floodwater. The sediment can partly cover the grasses and thus reduce their vigor and impair their growth.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the frequent flooding.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIw-7

*Windbreak suitability group:* 10
*Range site:* Clayey Overflow

## Ls—Lohmiller silty clay, 0 to 2 percent slopes, occasionally flooded

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 0 percent)
*Major use:* Hayland

### Composition

Lohmiller soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Craft soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—grayish brown, firm, calcareous silty clay

*Substratum:*
6 to 30 inches—light yellowish brown, firm, calcareous silty clay stratified with loam and silt loam
30 to 60 inches—light yellowish brown, firm, calcareous silty clay stratified with clay loam, silt loam, and silty clay loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.70 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Clayey alluvium
*Surface runoff:* Slow
*Flooding:* Occasional
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
• Craft soils, which contain less clay than the Lohmiller soil and are on the same landscapes

*Similar inclusions:*
• Channeled Lohmiller soils, which are frequently flooded, are dissected by meandering stream channels, and are on the lower parts of the landscape
• Soils with a surface layer of silty clay loam or clay loam

### Use and Management

**Cultivated crops**

*Suitability:*
• This soil is better suited to alfalfa and grasses than to row crops (fig. 11).
*Management concerns:*
• Because this soil is occasionally flooded for brief periods, crops can be damaged by scouring, standing water, or sedimentation.
*Management measures:*
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.
• The species suitable for planting are those that can tolerate occasional wetness.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the occasional flooding.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the occasional flooding.

### Interpretive Groups

*Land capability classification:* Dryland—IIIw-2; irrigated—IIIw-1
*Windbreak suitability group:* 1L
*Range site:* Clayey Overflow
*Irrigation design group:* 1

**Figure 11 —Hay in an area of Lohmiller silty clay, 0 to 2 percent slopes, occasionally flooded.**

## Mr—Mitchell very fine sandy loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Alluvial fans
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Cropland

### *Composition*

Mitchell soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Otero soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—light brownish gray, friable, calcareous very fine sandy loam

*Transitional layer:*
8 to 18 inches—pale brown, very friable, calcareous very fine sandy loam

*Substratum:*
18 to 31 inches—pale brown, very friable, calcareous very fine sandy loam
31 to 60 inches—very pale brown, very friable, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Bridget soils, which have a dark surface layer, are leached of lime to a depth of 10 to 15 inches, and are in the same landscape positions as the Mitchell soil

• Otero soils, which contain more sand and less silt than the Mitchell soil and are in the same landscape positions

*Similar inclusions:*
• Soils with a surface layer of silt loam
• Soils with a surface layer of fine sandy loam

### Use and Management

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIIc-1; irrigated—IIe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MrB—Mitchell very fine sandy loam, 1 to 3 percent slopes

### Setting

*Landform:* Alluvial fans
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### Composition

Mitchell soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Otero soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 7 inches—brown, very friable, calcareous very fine sandy loam

*Transitional layer:*
7 to 15 inches—very pale brown, very friable, calcareous very fine sandy loam

*Substratum:*
15 to 60 inches—very pale brown, calcareous very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
• Bridget soils, which have a dark surface layer, are leached of lime to depth of 10 to 15 inches, and are in the same landscape positions as the Mitchell soil
• Otero soils, which contain more sand and less silt than the Mitchell soil and are in the same landscape positions

*Similar inclusions:*
• Soils with a surface layer of silt loam
• Soils with a surface layer of fine sandy loam

### Use and Management

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Terraces, contour farming, and grassed waterways help to control water erosion.

• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MrC—Mitchell very fine sandy loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Foot slopes (fig. 12)
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major use:* Cropland

### *Composition*

Mitchell soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Otero soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—pale brown, very friable, calcareous very fine sandy loam

*Transitional layer:*
7 to 12 inches—very pale brown, very friable, calcareous very fine sandy loam

*Substratum:*
12 to 60 inches—very pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Bridget soils, which have a mollic epipedon
• Otero soils, which contain more sand and less silt than the Mitchell soil and are in the same landscape positions

*Similar inclusions:*
• Soils with a surface layer of silt loam
• Soils with a surface layer of fine sandy loam

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
• Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

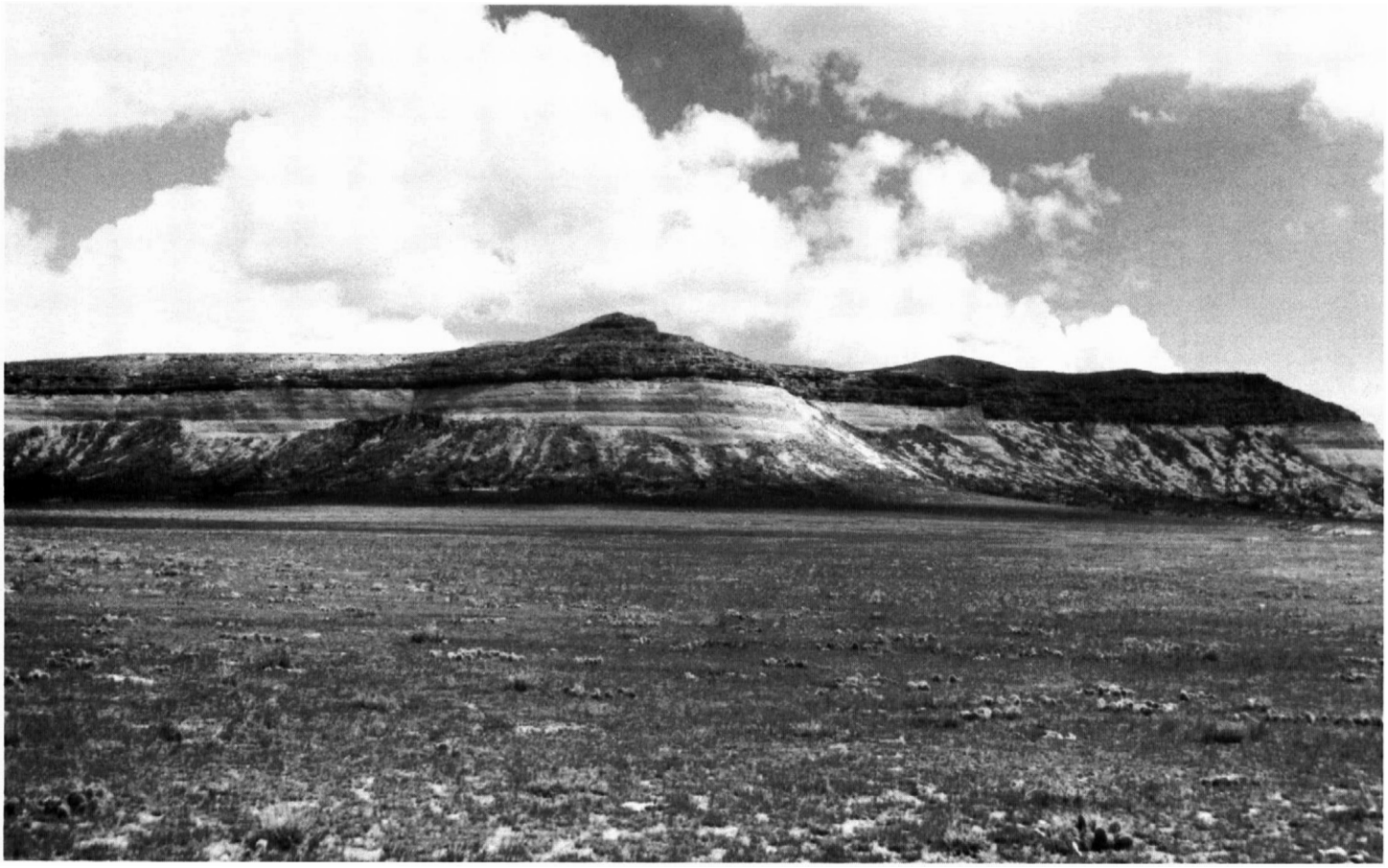

Figure 12.—An area of Mitchell very fine sandy loam, 3 to 6 percent slopes, used for grazing. Badland is in the background.

• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.
• Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIIe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## Mt—Mitchell silt loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Alluvial fans
*Slope range:* 0 to 1 percent (mainly 0 percent)
*Major use:* Cropland

### *Composition*

Mitchell soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Epping soils—0 to 5 percent

Thirtynine soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 7 inches—brown, friable silt loam

*Transitional layer:*
7 to 18 inches—very pale brown, very friable, calcareous silt loam

*Substratum:*
18 to 60 inches—very pale brown, calcareous silt loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.76 inches)
*Permeability:* Moderate (0.6 inch 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which contain more clay than the Mitchell soil and are lower on the landscape
- Epping soils, which are shallow to calcareous siltstone and are on knobs on the higher parts of the landscape
- Thirtynine soils, which have a dark surface layer, have more clay in the subsoil than the Mitchell soil, and are lower on the landscape

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam
- Soils that are silty clay loam throughout

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIc-1; irrigated—I-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MtB—Mitchell silt loam, 1 to 3 percent slopes

### Setting

*Landform:* Alluvial fans
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Cropland

### Composition

Mitchell soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Epping soils—0 to 5 percent
Thirtynine soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—light brownish gray, friable, calcareous silt loam

*Subsurface layer:*
5 to 9 inches—light gray, friable, calcareous silt loam

*Transitional layer:*
9 to 19 inches—light gray, friable, calcareous silt loam

*Substratum:*
19 to 60 inches—light gray, calcareous silt loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.76 inches)
*Permeability:* Moderate (0.6 inch 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which contain more clay than the Mitchell soil and are lower on the landscape
- Epping soils, which are shallow to calcareous siltstone and are on knobs on the higher parts of the landscape
- Thirtynine soils, which contain more clay than the Mitchell soil, have a dark surface layer, and are on the lower parts of the landscape

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam
- Soils that are light silty clay loam throughout

### Use and Management

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Contour farming and grassed waterways help to control water erosion.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIe-9; irrigated—IIe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MtC—Mitchell silt loam, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Foot slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major use:* Cropland

### Composition

Mitchell soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Epping soils—0 to 5 percent
Thirtynine soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—grayish brown, very friable, calcareous silt loam

*Transitional layer:*
5 to 15 inches—pale brown, very friable, calcareous silt loam

*Substratum:*
15 to 60 inches—very pale brown, calcareous silt loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained

*Available water capacity:* High (11.76 inches)
*Permeability:* Moderate (0.6 inch 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which contain more clay than the Mitchell soil and are lower on the landscape
- Epping soils, which are shallow to calcareous siltstone and are on knobs on the higher parts of the landscape
- Thirtynine soils, which contain more clay than the Mitchell soil, have a dark surface layer, and are on the lower parts of the landscape

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam
- Soils that are silty clay loam throughout

### Use and Management

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIIe-9; irrigated—IIIe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MtD—Mitchell silt loam, 6 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 6 to 9 percent (mainly 7 percent)
*Major uses:* Rangeland and cropland

### Composition

Mitchell soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Epping soils—0 to 5 percent
Thirtynine soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—pale brown, very friable silt loam

*Transitional layer:*
5 to 15 inches—pale brown, very friable, calcareous loam

*Substratum:*
15 to 38 inches—pale brown, calcareous silt loam
38 to 60 inches—very pale brown, calcareous silt loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.66 inches)
*Permeability:* Moderate (0.6 inch 2.0 inches/hour)

*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
- Bufton soils, which contain more clay than the Mitchell soil and are lower on the landscape
- Epping soils, which have calcareous siltstone bedrock at a depth of 6 to 20 inches and are on knobs on the higher parts of the landscape
- Thirtynine soils, which contain more clay than the Mitchell soil, have a dark surface layer, and are on the lower parts of the landscape

*Similar inclusions:*
- Soils that have a surface layer very fine sandy loam or loam
- Soils that are light silty clay loam throughout

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- Gravity methods of irrigation are not suitable.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-9; irrigated—IVe-6
*Windbreak suitability group:* 8
*Range site:* Limy Upland
*Irrigation design group:* 6

## MtE—Mitchell silt loam, 9 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 9 to 20 percent (mainly 13 percent)
*Major use:* Rangeland

### *Composition*

Mitchell soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Epping soils—0 to 5 percent
Bufton soils—0 to 5 percent
Ponderosa soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—brown, friable, calcareous silt loam

*Subsurface layer:*
4 to 10 inches—pale brown, friable, calcareous silt loam

*Transitional layer:*
10 to 24 inches—pale brown, friable, calcareous silt loam

*Substratum:*
24 to 60 inches—very pale brown, calcareous silt loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.64 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone

*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
- Epping soils, which have calcareous siltstone bedrock at a depth of 6 to 20 inches and are higher on the landscape than the Mitchell soil
- Bufton soils, which contain more clay than the Mitchell soil and are lower on the landscape
- Ponderosa soils, which contain more sand than the Mitchell soil, are leached of lime to a greater depth, have a dark surface layer, and are in areas above the Mitchell soil

*Similar inclusions:*
- Soils with a surface layer of very fine sandy loam or loam
- Soils with bedrock at a depth of 40 to 60 inches

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
- Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the moderate permeability and the slope
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.
- Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-9
*Windbreak suitability group:* 8
*Range site:* Limy Upland

## MxD—Mitchell-Epping complex, 3 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Mitchell—foot slopes and back slopes; Epping—summits and shoulders
*Slope range:* Mitchell—3 to 9 percent (mainly 5 percent); Epping—3 to 9 percent (mainly 8 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Mitchell soil and similar soils: 50 percent (plus or minus 5 percent)
Epping soil and similar soils: 35 percent (plus or minus 5 percent)
Contrasting inclusions:
- Ashollow soils—0 to 5 percent
- Siltstone outcrops—0 to 5 percent
- Soils that are 20 to 40 inches deep over siltstone—0 to 5 percent

### *Typical Profile*

**Mitchell**

*Surface layer:*
0 to 10 inches—pale brown, very friable, calcareous very fine sandy loam

*Transitional layer:*
10 to 18 inches—pale brown, very friable, calcareous very fine sandy loam

*Substratum:*
18 to 28 inches—very pale brown, calcareous very fine sandy loam
28 to 60 inches—very pale brown, calcareous silt loam

**Epping**

*Surface layer:*
0 to 5 inches—pale brown, calcareous, very friable very fine sandy loam

*Transitional layer:*
5 to 12 inches—very pale brown, calcareous, very friable very fine sandy loam

*Substratum:*
12 to 18 inches—very pale brown, calcareous silt loam that has 5 percent gravel-sized fragments of calcareous siltstone, by volume
18 to 60 inches—very pale brown, calcareous siltstone

## *Soil Properties and Qualities*

### Mitchell

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.96 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### Epping

*Depth to paralithic contact:* 10 to 20 inches (mainly 18 inches)
*Potential rooting depth:* Shallow (18 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.30 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

## *Inclusions*

*Contrasting inclusions:*
- Ashollow soils, which contain more sand than the Mitchell and Epping soils and are in similar positions on the landscape
- Siltstone outcrops, which are on knolls and ridgetops
- Soils with siltstone at a depth of 20 to 40 inches

*Inclusions similar to the Mitchell soil:*
- Soils that have a surface layer of dark colored silt loam

*Inclusions similar to the Epping soil:*
- Soils that have a surface layer of dark colored silt loam
- Soils that have bedrock within a depth of 6 inches

## *Use and Management*

### Cultivated crops

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.

### Rangeland and hay

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

### Windbreaks

*Suitability:* Mitchell—suited; Epping—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Mitchell*

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Only those species that can tolerate a high content of calcium should be selected for planting.

### Dwellings

*Mitchell*

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

*Epping*

*Management concerns:* Moderate limitations on sites for dwellings without basements because of the shrink-swell potential and the depth to bedrock; a severe limitation on sites for dwellings with basements because of the depth to bedrock
*Management measures:*:
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

### Septic tank absorption fields

*Suitability:* Mitchell—suited; Epping—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Mitchell*

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Mitchell—IVe-3, dryland, and IVe-6, irrigated; Epping—VIs-4, dryland
*Windbreak suitability group:* Mitchell—8; Epping—10
*Range site:* Mitchell—Limy Upland; Epping—Shallow Limy
*Irrigation design group:* Mitchell—3

## MxF—Mitchell-Epping complex, 9 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Mitchell—back slopes and foot slopes; Epping—summits and shoulders
*Slope range:* Mitchell—9 to 30 percent (mainly 13 percent); Epping—9 to 30 percent (mainly 20 percent)
*Major use:* Rangeland

### *Composition*

Mitchell soil and similar soils: 60 percent (plus or minus 5 percent)
Epping soil and similar soils: 30 percent (plus or minus 5 percent)
Contrasting inclusions:
Rock outcrop—0 to 5 percent
Soils that are 20 to 40 inches deep over bedrock—0 to 5 percent

### *Typical Profile*

**Mitchell**

*Surface layer:*
0 to 4 inches—brown, very friable, calcareous silt loam

*Subsurface layer:*
4 to 10 inches—pale brown, very friable, calcareous silt loam

*Transitional layer:*
10 to 18 inches—very pale brown, very friable, calcareous silt loam

*Substratum:*
18 to 60 inches—very pale brown, calcareous silt loam

**Epping**

*Surface layer:*
0 to 4 inches—brown, very friable, calcareous silt loam

*Transitional layer:*
4 to 12 inches—pale brown, very friable, calcareous silt loam

*Substratum:*
12 to 18 inches—very pale brown, calcareous silt loam
18 to 60 inches—white, calcareous siltstone

### *Soil Properties and Qualities*

**Mitchell**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.64 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Colluvial and alluvial material weathered from calcareous siltstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

**Epping**

*Depth to paralithic contact:* 10 to 20 inches (mainly 18 inches)
*Potential rooting depth:* Shallow (18 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.66 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous siltstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Siltstone outcrops, which are on ridges on the high parts of landscape
• Soils that have bedrock at a depth of 20 to 40 inches

*Inclusions similar to the Mitchell soil:*
• Soils that have a surface layer of silty clay loam

*Inclusions similar to the Epping soil:*
• Soils that have a surface layer of very fine sandy loam
• Soils that have a surface layer of silty clay loam

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Mitchell*

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient in areas where the slope is less than 15 percent.

*Epping*

*Management concerns:* Severe limitations because of the slope and the depth to bedrock
*Management measures*:
• Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock should be graded in areas where the slope is less than 15 percent.

**Septic tank absorption fields**

*Suitability:* Mitchell—suited only in areas where the slope is less than 15 percent; Epping—not suited because of the depth to bedrock
• Onsite investigation is needed to identify the best suited areas.

*Mitchell*

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Mitchell—VIe-9, dryland; Epping—VIs-4, dryland
*Windbreak suitability group:* Mitchell—10; Epping—10
*Range site:* Mitchell—Limy Upland; Epping—Shallow Limy

## NrB—Norrest clay loam, 1 to 3 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Broad summits
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Rangeland

### Composition

Norrest soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Orella soils—0 to 5 percent
Pierre soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—grayish brown, friable clay loam

*Subsoil:*
6 to 12 inches—pale brown, firm, calcareous silty clay
12 to 18 inches—very pale brown, firm, calcareous silty clay
18 to 24 inches—light gray, firm, calcareous silty clay loam

*Substratum:*
24 to 60 inches—light gray, bedded, calcareous silty shale

### Soil Properties and Qualities

*Depth to paralithic contact:* 20 to 40 inches (mainly 24 inches)
*Potential rooting depth:* 20 to 40 inches
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.84 inches)
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate
*Distinctive property:* Chalcedony fragments are commonly scattered on the surface and throughout the profile.

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which are deep and are on landscapes similar to those of the Norrest soil
- Orella soils, which are shallow and are higher on the landscape than the Norrest soil
- Pierre soils, which contain more clay in the subsoil than the Norrest soil and are on similar landscapes

*Similar inclusions:*
- Some areas where silty shale bedrock is below a depth of 40 inches
- Some areas where the surface layer is silt loam or silty clay loam

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the moderately slow permeability.

### Interpretive Groups

*Land capability classification:* Dryland—IIIe-1; irrigated—IIIe-3
*Windbreak suitability group:* 4L
*Range site:* Clayey
*Irrigation design group:* 3

## NrD—Norrest clay loam, 3 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Shoulders, back slopes, and foot slopes
*Slope range:* 3 to 9 percent (mainly 5 percent)
*Major uses:* Rangeland and cropland

### Composition

Norrest soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Orella soils—0 to 5 percent
Pierre soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—dark grayish brown, friable clay loam

*Subsoil:*
4 to 10 inches—brown, firm silty clay loam
10 to 17 inches—brown, firm, calcareous silty clay loam
17 to 24 inches—light gray, calcareous silty clay loam

*Substratum:*
24 to 60 inches—light olive gray, bedded, calcareous silty shale

### Soil Properties and Qualities

*Depth to paralithic contact:* 20 to 40 inches (mainly 24 inches)
*Potential rooting depth:* 20 to 40 inches
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (4.28 inches)
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate
*Distinctive property:* Chalcedony fragments are commonly scattered on the surface and throughout the profile.

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which are deep and are on landscapes similar to those of the Norrest soil

- Orella soils, which are shallow and are higher on the landscape than the Norrest soil
- Pierre soils, which contain more clay in the subsoil than the Norrest soil and are in similar positions on the landscape

*Similar inclusions:*
- Some areas where the silty shale bedrock is below a depth of 40 inches
- Some areas where the surface layer is silt loam or silty clay loam

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the moderately slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-1; irrigated—IVe-3
*Windbreak suitability group:* 4L
*Range site:* Clayey
*Irrigation design group:* 3

## OgB—Oglala very fine sandy loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Broad summits
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Rangeland and cropland

### *Composition*

Oglala soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Canyon soils—0 to 5 percent
Satanta soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—grayish brown, very friable very fine sandy loam

*Subsurface layer:*
7 to 14 inches—brown, very friable very fine sandy loam

*Transitional layer:*
14 to 27 inches—brown, very friable very fine sandy loam

*Substratum:*
27 to 48 inches—pale brown, calcareous very fine sandy loam
48 to 60 inches—light gray, calcareous sandstone

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 40 to 60 inches (mainly 48 inches)
*Potential rooting depth:* 40 to 60 inches
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained

*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Busher soils, which contain more sand than the Oglala soil and are on the same landscapes
- Canyon soils, which have bedrock at a depth of 6 to 20 inches and are higher on the landscape than the Oglala soil
- Satanta soils, which contain more clay than the Oglala soil and are on similar landscapes

*Similar inclusions:*
- Soils that have a surface layer of loam or silt loam
- Soils that have a surface layer of loamy very fine sand
- Soils that have bedrock at a depth of 20 to 40 inches

### Use and Management

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Contour farming and grassed waterways help to control water erosion
- Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the moderate permeability and seepage
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.
- Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### Interpretive Groups

*Land capability classification:* Dryland—IIe-3; irrigated—IIe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## OgC—Oglala very fine sandy loam, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Shoulders, back slopes, and foot slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major uses:* Rangeland and cropland

### Composition

Oglala soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Canyon soils—0 to 5 percent
Satanta soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 10 inches—grayish brown, very friable very fine sandy loam

*Transitional layer:*
10 to 24 inches—brown, very friable very fine sandy loam

*Substratum:*
24 to 36 inches—brown very fine sandy loam
36 to 58 inches—pale brown, calcareous very fine sandy loam
58 to 60 inches—light gray, calcareous sandstone

### Soil Properties and Qualities

*Depth to paralithic contact:* 40 to 60 inches (mainly 58 inches)
*Potential rooting depth:* 40 to 60 inches

*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which contain more sand than the Oglala soil and are on the same landscapes
- Canyon soils, which have bedrock at a depth of 6 to 20 inches and are higher on the landscape than the Oglala soil
- Satanta soils, which contain more clay than the Oglala soil and are on similar landscapes

*Similar inclusions:*
- Soils with a surface layer of loam or silt loam
- Soils with a surface layer of loamy very fine sand
- Soils with bedrock at a depth of 20 to 40 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the moderate permeability and seepage
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.
- Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIIe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## OgD—Oglala very fine sandy loam, 6 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 6 to 9 percent (mainly 7 percent)
*Major uses:* Rangeland and cropland

### *Composition*

Oglala soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Canyon soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 5 inches—grayish brown, friable very fine sandy loam

*Subsurface layer:*
5 to 11 inches—brown, friable very fine sandy loam

*Transitional layer:*
11 to 24 inches—brown, friable very fine sandy loam

*Substratum:*
24 to 48 inches—pale brown, calcareous very fine sandy loam
48 to 60 inches—light gray, calcareous sandstone

### Soil Properties and Qualities

*Depth to paralithic contact:* 40 to 60 inches (mainly 48 inches)
*Potential rooting depth:* 40 to 60 inches
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Busher soils, which contain more sand than the Oglala soil and are on the same landscapes
- Canyon soils, which have bedrock at a depth of 6 to 20 inches and are higher on the landscape than the Oglala soil

*Similar inclusions:*
- Soils that have a surface layer of loam or silt loam
- Soils that have a surface layer of loamy very fine sand
- Soils that have bedrock at a depth of 20 to 40 inches

### Use and Management

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* Moderate limitations because of the moderate permeability and seepage
*Management measures:*
- The restricted permeability generally can be overcome by increasing the size of the absorption field.
- Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock

### Interpretive Groups

*Land capability classification:* Dryland—IVe-3; irrigated—IVe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## OnD—Oglala-Canyon complex, 3 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Oglala—back slopes and foot slopes; Canyon—summits and shoulders
*Slope range:* Oglala—3 to 9 percent (mainly 6 percent); Canyon—3 to 9 percent (mainly 8 percent)
*Major uses:* Cropland and rangeland

### Composition

Oglala soil and similar soils: 55 percent (plus or minus 10 percent)
Canyon soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Tassel soils—0 to 5 percent
Vetal soils—0 to 5 percent

### *Typical Profile*

**Oglala**

*Surface layer:*
0 to 13 inches—grayish brown, very friable very fine sandy loam

*Transitional layer:*
13 to 28 inches—grayish brown, very friable very fine sandy loam

*Substratum:*
28 to 49 inches—light brownish gray, very friable very fine sandy loam
49 to 60 inches—light gray, calcareous sandstone

**Canyon**

*Surface layer:*
0 to 4 inches—brown, very friable, calcareous very fine sandy loam

*Transitional layer:*
4 to 10 inches—brown, very friable, calcareous very fine sandy loam

*Substratum:*
10 to 15 inches—pale brown, calcareous very fine sandy loam
15 to 60 inches—light gray, calcareous sandstone

### *Soil Properties and Qualities*

**Oglala**

*Depth to paralithic contact:* 40 to 60 inches (mainly 55 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 50 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

**Canyon**

*Depth to paralithic contact:* 6 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 10 to 20 inches (mainly 15 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.67 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which have more sand than the Oglala soil and are in similar landscape positions
- Vetal soils, which have more sand than the Oglala soil and are in lower landscape positions
- Tassel soils, which have more sand than the Canyon soil and are in similar landscape positions

*Inclusions similar to the Oglala soil:*
- Soils that have bedrock below a depth of 60 inches
- Soils in which the dark surface soil is more than 20 inches thick
- Soils that have a texture of loam

*Inclusions similar to the Canyon soil:*
- Soils that have a surface layer and substratum of loam
- Soils that have a dark surface soil and are leached of carbonates

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because of irregular slopes.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Oglala*

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.

• Strips of sod or cover crops between the tree rows help to control soil blowing.

*Canyon*

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Oglala*

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

*Canyon*

*Management concerns:* A moderate limitation on sites for dwellings without basements and a severe limitation on sites for dwellings with basements because of the depth to bedrock
*Management measures:*
• The soft bedrock generally can be excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Suitability:* Oglala—suited; Canyon—unsuited because of the depth to bedrock
• Onsite investigation can identify the best suited areas.

*Oglala*

*Management concerns:* Moderate limitations because of seepage and the moderate permeability
*Management measures:*
• Suitable fill material can raise the absorption field a sufficient distance above the sandstone bedrock.
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Oglala—IVe-3, dryland, and IVe-6, irrigated; Canyon—VIs-4, dryland
*Windbreak suitability group:* Oglala—3; Canyon—10
*Range site:* Oglala—Silty; Canyon—Shallow Limy
*Irrigation design group:* Oglala—6

## OnF—Oglala-Canyon complex, 9 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Oglala—back slopes and foot slopes; Canyon—summits and shoulders
*Slope range:* Oglala—9 to 20 percent (mainly 14 percent); Canyon—9 to 30 percent (mainly 20 percent)
*Major use:* Rangeland

### *Composition*

Oglala soil and similar soils: 55 percent (plus or minus 10 percent)
Canyon soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Vetal soils—0 to 5 percent
Rock outcrop—0 to 5 percent

### *Typical Profile*

**Oglala**

*Surface layer:*
0 to 15 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
15 to 48 inches—grayish brown, very friable very fine sandy loam

*Substratum:*
48 to 55 inches—pale brown, calcareous very fine sandy loam
55 to 60 inches—white, calcareous sandstone

**Canyon**

*Surface layer:*
0 to 4 inches—brown, very friable very fine sandy loam

*Transitional layer:*
4 to 8 inches—brown, very friable, calcareous very fine sandy loam

*Substratum:*
8 to 12 inches—pale brown, calcareous very fine sandy loam
12 to 60 inches—very pale brown, calcareous sandstone

### *Soil Properties and Qualities*

**Oglala**

*Depth to paralithic contact:* 40 to 60 inches (mainly 55 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 55 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.95 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe

*Hazard of soil blowing:* Severe

**Canyon**

*Depth to paralithic contact:* 6 to 20 inches (mainly 12 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 12 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.45 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Severe

## Inclusions

*Contrasting inclusions:*
- Busher soils, which have more sand in the subsoil than the Oglala soil and are in about the same landscape positions
- Vetal soils, which have a dark surface layer that is more than 20 inches thick, do not have bedrock within a depth of 60 inches, and are in areas below Oglala soil
- Rock outcrops, which are barren exposures of calcareous sandstone that are on high, rounded knobs above the Oglala and Canyon soils

*Inclusions similar to the Oglala soil:*
- Soils that have a surface layer of light colored loamy very fine sand
- Some areas where calcareous sandstone is below a depth of 60 inches

*Inclusions similar to the Canyon soil:*
- Soils that have a surface layer and underlying material of loam
- Soils that have a dark surface layer and are leached of carbonates

## Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Oglala*

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.
- Strips of sod or cover crops between the tree rows help to control soil blowing.

*Canyon*

*Suitability:* Generally not suited
- A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Oglala*

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded to an acceptable gradient.

*Canyon*

*Management concerns:* A severe limitation on sites for dwellings without basements because of the slope and severe limitations on sites for dwellings with basements because of the slope and the depth to bedrock
*Management measures:*
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.
- Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

**Septic tank absorption fields**

*Suitability:* Oglala—suited only in areas where the slope is less than 15 percent; Canyon—not suited because of the depth to bedrock
- Onsite investigation is needed to identify the best suited areas.

*Oglala*

*Management measures:*
- The restricted permeability of this soil generally can be overcome by increasing the size of the absorption field.
- Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### Interpretive Groups

*Land capability classification:* Oglala—VIe-3, dryland; Canyon—VIs-4, dryland
*Windbreak suitability group:* Oglala—3; Canyon—10
*Range site:* Oglala—Silty; Canyon—Shallow Limy

## OpD—Olney loam, 3 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Slope range:* 3 to 9 percent (mainly 6 percent)
*Major use:* Rangeland

### Composition

Olney soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bufton soils—0 to 5 percent
Norrest soils—0 to 5 percent
Pierre soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—grayish brown, very friable loam

*Subsoil:*
4 to 10 inches—brown, friable sandy clay loam
10 to 14 inches—brown, very friable fine sandy loam
14 to 20 inches—pale brown, very friable, calcareous fine sandy loam

*Substratum:*
20 to 60 inches—pale brown, calcareous sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.56 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy eolian sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
- Bufton soils, which contain more clay than the Olney soil and are in similar landscape positions
- Norrest soils, which are moderately deep, contain more clay in the subsoil than the Olney soil, and are higher on the landscape
- Pierre soils, which are moderately deep, contain more clay than the Olney soil, and are higher on the landscape

*Similar inclusions:*
- Some areas where the surface layer is dark or is fine sandy loam

### Use and Management

**Cultivated crops**

*Management measures:*
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-1; irrigated—IIIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## OrF—Orella clay, 1 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes (fig. 13)
*Slope range:* 1 to 30 percent (mainly 17 percent)
*Major use:* Rangeland

### *Composition*

Orella soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
- Badland—0 to 3 percent
- Bufton soils—0 to 4 percent
- Norrest soils—0 to 4 percent
- Samsil soils—0 to 4 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—light brownish gray, very firm, calcareous clay

*Transitional layer:*
4 to 9 inches—light brownish gray, very firm, calcareous clay

*Substratum:*
9 to 15 inches—light gray, calcareous clay
15 to 60 inches—light gray, calcareous, bedded silty shale

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 10 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 10 to 20 inches
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.07 inches)
*Permeability:* Very slow (less than 0.06 inch/hour) above paralithic contact
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate
*Distinctive property:* A high content of salts and sodium

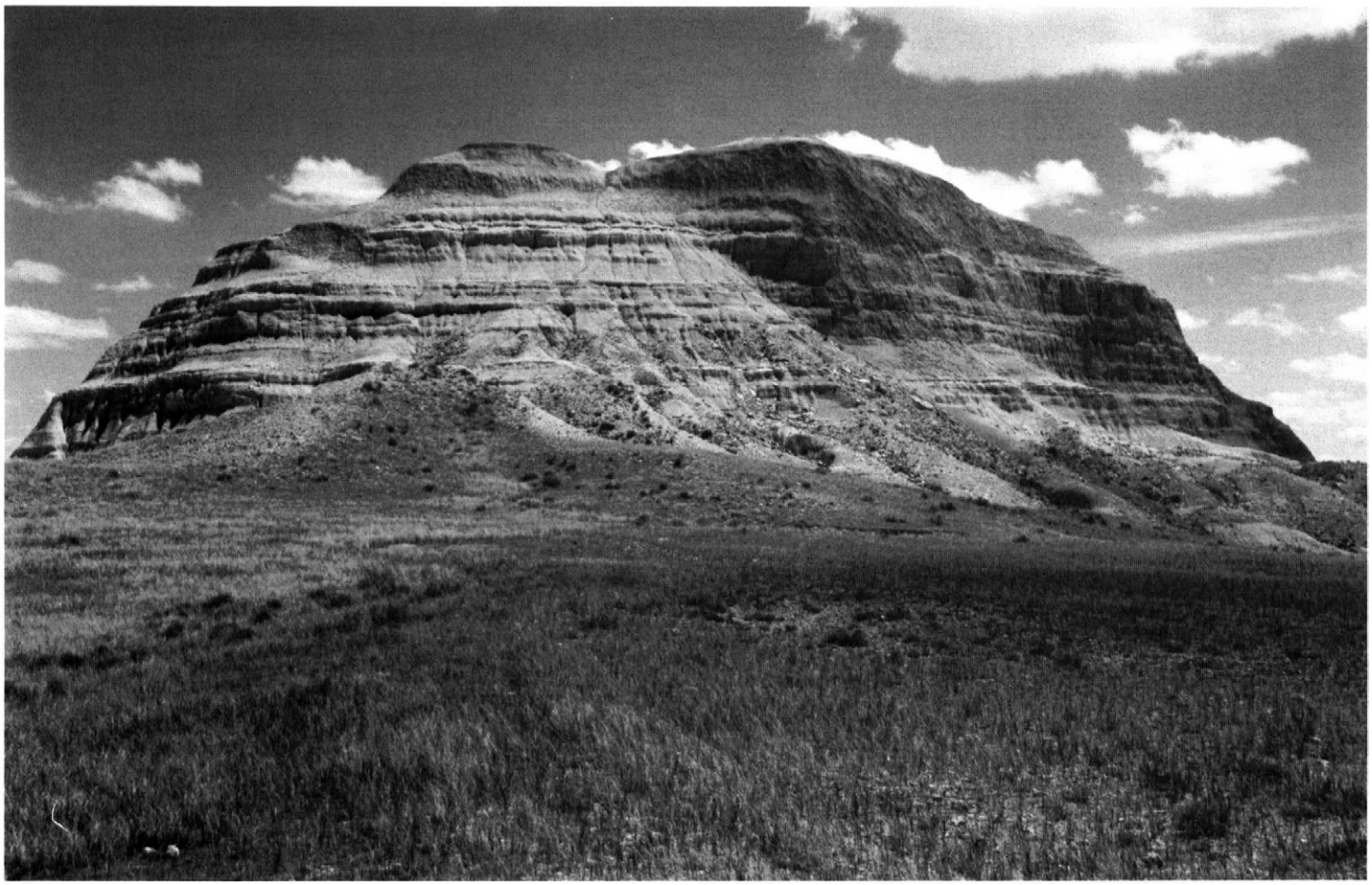

**Figure 13.—An area of Orella clay, 1 to 30 percent slopes, adjacent to Sugarloaf Butte.**

### Inclusions

*Contrasting inclusions:*
- Badland, which is barren, occurs as highly erodible areas of shale and siltstone, and is on the high parts of the landscape
- Bufton soils, which are deep and are lower on the landscape than the Orella soil
- Norrest soils, which are moderately deep and have an increase in content of clay in the subsoil
- Samsil soils, which do not have a high content of sodium and salts and are below the areas of the Orella soil

*Similar inclusions:*
- Some areas where the surface layer is silty clay loam or clay loam

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
- A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Management concerns:* Severe limitations because of the slope, the shrink-swell potential, and the depth to bedrock
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the slope.

### Interpretive Groups

*Land capability classification:* Dryland—VIs-4
*Windbreak suitability group:* 10
*Range site:* Saline Upland

## OsG—Orella-Badland complex, 3 to 50 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Orella—summits and shoulders; Badland—back slopes and foot slopes
*Slope range:* Orella—3 to 30 percent (mainly 16 percent); Badland—9 to 50 percent (mainly 35 percent)
*Major uses:* Rangeland and wildlife habitat

### Composition

Orella soil and similar soils: 55 percent (plus or minus 15 percent)
Badland: 35 percent (plus or minus 15 percent)
Contrasting inclusions:
Norrest soils—0 to 5 percent
Samsil soils—0 to 5 percent

### Typical Profile

**Orella**

*Surface layer:*
0 to 5 inches—grayish brown, very firm, calcareous clay

*Transitional layer:*
5 to 12 inches—light brownish gray, very firm, calcareous clay

*Substratum:*
12 to 18 inches—light gray, calcareous clay
18 to 60 inches—light gray, bedded shale

### Characteristics of the Badland

- Badland consists of actively eroding areas of white and light gray shale and siltstone. Some areas have sandstone boulders and fragments of chalcedony and gypsum on the surface. The Badland supports little or no vegetation.

### Soil Properties and Qualities

**Orella**

*Depth to paralithic contact:* 10 to 20 inches (mainly 15 inches)
*Depth to unconsolidated material that has shale fragments:* 6 to 18 inches (mainly 14 inches)
*Potential rooting depth:* 10 to 20 inches (mainly 15 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained

*Available water capacity:* Very low (2.46 inches)
*Permeability:* Very slow (less than 0.06 inch/hour) above paralithic contact
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate
*Distinctive property:* The soil is affected by alkalinity and salinity.

**Badland**

*Depth to paralithic contact:* 0 inches
*Potential rooting depth:* 0 inches
*Content of organic matter:* Very low (less than 0.5 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Very low (less than 1.0 inch)
*Permeability:* Very slow (less than 0.06 inch/hour)
*Parent material:* Shale and siltstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Very severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
- Norrest soils, which are 20 to 40 inches deep over shale and are on the smoother, less sloping parts of the landscape
- Samsil soils, which are not high in content of sodium and salts and are on the lower parts of landscape

*Inclusions similar to the Orella soil:*
- Some areas where the surface layer is clay loam or silty clay loam

*Inclusions similar to Badland.*
- Areas that have 1 to 3 inches of silt loam, silty clay loam, and clay over siltstone or shale

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.
- Careful management is needed in very strongly alkaline areas, which support little or no vegetation and are subject to severe soil blowing during dry periods.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock, the slope, and the shrink-swell potential.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock and the slope.

### *Interpretive Groups*

*Land capability classification:* Orella—VIs-4, dryland; Badland—VIIIs-8, dryland
*Windbreak suitability group:* Orella—10; Badland—10
*Range site:* Orella—Saline Upland; Badland—none

## OwB—Otero loamy very fine sand, 0 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Otero soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Valent soils—0 to 10 percent
Soils that have more than 15 percent gravel, by volume, below a depth of 40 inches—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—brown, very friable, calcareous loamy very fine sand

*Transitional layer:*
7 to 15 inches—pale brown, very friable, calcareous loamy very fine sand

*Substratum:*
15 to 60 inches—very pale brown, very friable, calcareous loamy very fine sand that has 3 percent gravel-sized sandstone fragments, by volume

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained

*Available water capacity:* Moderate (7.68 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Valent soils, which are sandy, are excessively drained, and are on hummocks and dunes
- Soils that have more than 15 percent, by volume, sandstone gravel below a depth of 40 inches and are on landscapes similar to those of the Otero soil

*Similar inclusions:*
- Soils that are leached of carbonates to a depth of 10 to 40 inches

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation systems were used.

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
- Only those species that can tolerate a high content of calcium should be selected for planting.
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IIIe-10
*Windbreak suitability group:* 8
*Range site:* Sandy
*Irrigation design group:* 10

## Pa—Pathfinder loamy fine sand, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### Composition

Pathfinder soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Glenberg soils—0 to 10 percent
Bankard soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 5 inches—grayish brown, very friable, calcareous loamy fine sand

*Substratum:*
5 to 18 inches—light brownish gray, calcareous fine sand
18 to 29 inches—light brownish gray, calcareous fine sandy loam
29 to 38 inches—light brownish gray, calcareous loamy fine sand
38 to 60 inches—pale brown, calcareous fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Low (5.44 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A high content of sodium in the substratum

### Inclusions

*Contrasting inclusions:*
- Glenberg soils, which contain less sand than the Pathfinder soil and are on similar landscapes
- Bankard soils, which are not affected by sodium and are on landscapes similar to those of the Pathfinder soil

*Similar inclusions:*
- Soils that have a surface layer of fine sandy loam or fine sand
- Soils that have 1 to 10 percent gravel, by volume, in the substratum

### Use and Management

**Cultivated crops**

*Management measures:*
- Furrow, border, and sprinkler irrigation systems can be used.
- Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
- If an area is reseeded, the species selected for planting should be those that are suited to a saline or alkali soil.
- Tall wheatgrass and switchgrass can be grown on this alkali-saline soil.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Alkali-tolerant species should be selected for planting.
- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the surface as possible.

**Dwellings**

*Management concerns:* A severe limitation because of the rare flooding
*Management measures:*
- Dwellings should be constructed on well compacted fill material, which helps to prevent the damage caused by floodwater.

**Septic tank absorption fields**

*Management concerns:* Severe limitations because of a poor filtering capacity and the rare flooding
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

*Management measures:*
- Building up or mounding the site with suitable fill material increases the filtering capacity.
- The hazard of rare flooding should be considered if this soil is used as a site for septic tank absorption fields.

### Interpretive Groups

*Land capability classification:* Dryland—VIs-1; irrigated—IVs-11
*Windbreak suitability group:* 9N
*Range site:* Saline Lowland
*Irrigation design group:* 11

## PhF—Phiferson-Tassel-Rock outcrop complex, 6 to 30 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Phiferson—back slopes and foot slopes; Tassel and Rock outcrop—summits and shoulders
*Slope range:* Phiferson—6 to 25 percent (mainly 15 percent); Tassel—6 to 30 percent (mainly 25 percent); Rock outcrop 9 to 30 percent (mainly 28 percent)
*Major use:* Rangeland

### Composition

Phiferson soil and similar soils: 40 percent (plus or minus 10 percent)
Tassel soil and similar soils: 35 percent (plus or minus 10 percent)
Rock outcrop 10 percent (plus or minus 5 percent)
Contrasting inclusions:
- Busher soils—0 to 5 percent
- Jayem soils—0 to 5 percent
- Vetal soils—0 to 5 percent

### Typical Profile

**Phiferson**

*Surface layer:*
0 to 8 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
8 to 20 inches—pale brown, very friable very fine sandy loam

*Substratum:*
20 to 28 inches—pale brown, loose loamy very fine sand
28 to 33 inches—very pale brown, loose, calcareous

loamy very fine sand that has 10 percent gravel-sized fragments of sandstone, by volume
33 to 60 inches—white, calcareous sandstone

**Tassel**

*Surface layer:*
0 to 4 inches—light brownish gray, very friable loamy very fine sand

*Substratum:*
4 to 17 inches—very pale brown, loose, calcareous loamy very fine sand that has 10 percent gravel-sized fragments of sandstone, by volume
17 to 60 inches—white, calcareous sandstone

## Soil Properties and Qualities

**Phiferson**

*Depth to paralithic contact:* 20 to 40 inches (mainly 30 inches)
*Potential rooting depth:* 20 to 40 inches (mainly 30 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (4.94 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 13 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 12 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.40 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour) above paralithic contact
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Rock outcrop**

*Depth to paralithic contact:* 0 inches
*Potential rooting depth:* 0 inches
*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Calcareous sandstone
*Surface runoff:* Very rapid

## Inclusions

*Contrasting inclusions:*
- Busher soils, which have calcareous sandstone bedrock at a depth of 40 to 60 inches and are on landscapes similar to those of the Phiferson soil
- Jayem soils, which do not have calcareous sandstone bedrock within a depth of 60 inches and are in areas below the Phiferson and Tassel soils
- Vetal soils, which are dark to a depth of more than 20 inches, do not have calcareous sandstone bedrock within a depth of 60 inches, and are in swales below the Phiferson and Tassel soils

*Inclusions similar to the Phiferson soil:*
- Soils that have a surface layer of loamy fine sand or very fine sandy loam

*Inclusions similar to the Tassel soil:*
- Soils that have a dark surface layer and contain less sand

## Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Phiferson*

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

*Tassel*

*Suitability:* Generally not suited
- A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Suitability:* Phiferson—suited only in areas where the slope is less than 15 percent; Tassel and Rock outcrop—not suited

• Onsite investigation is needed to identify the best suited areas.

*Phiferson*

*Management concerns:* Severe limitations because of the depth to bedrock and the slope
*Management measures:*
• Grading helps to keep surface runoff away from the buildings.
• The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the slope and the depth to bedrock.

### *Interpretive Groups*

*Land capability classification:* Phiferson—VIe-5, dryland; Tassel—VIs-4, dryland; Rock outcrop—VIIIs-8
*Windbreak suitability group:* Phiferson—6R; Tassel—10; Rock outcrop—10
*Range site:* Phiferson—Sandy; Tassel—Shallow Limy; Rock outcrop—none

## PrC—Pierre clay, 1 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits and shoulders
*Slope range:* 1 to 6 percent (mainly 5 percent)
*Major use:* Rangeland

### *Composition*

Pierre soil and similar soils: 85 to 90 percent
Contrasting inclusions:
Bufton soils—0 to 5 percent
Kyle soils—0 to 5 percent
Samsil soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, very firm, calcareous clay

*Subsoil:*
4 to 20 inches—light brownish gray, extremely firm, calcareous clay
20 to 30 inches—light brownish gray, calcareous clay that has about 10 percent fragments of soft shale, by volume

*Substratum:*
30 to 60 inches—light brownish gray shale

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 20 to 40 inches (mainly 30 inches)
*Potential rooting depth:* 20 to 40 inches
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.88 inches)
*Permeability:* Very slow (less than 0.06 inches/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate
*Distinctive properties:* Some areas have many scattered fragments of chalcedony. In some areas the substratum has 5 to 35 percent fragments of soft shale, by volume.

### *Inclusions*

*Contrasting inclusions:*
• Bufton soils, which have less clay than the Pierre soil, have shale at a depth of more than 40 inches, and are in landscape positions similar to those of the Pierre soil
• Kyle soils, which have shale at a depth of more than 40 inches and are lower on the landscape than the Pierre soil
• Samsil soils, which have shale at a depth of 6 to 20 inches and are on landscapes similar to those of the Pierre soil

*Similar inclusion:*
• Soils that have a surface layer of silty clay

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Light cultivation and supplemental watering can close

the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.
• Planting the trees on the contour helps to control water erosion and conserves soil moisture.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the depth to bedrock and the very slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-4
*Windbreak suitability group:* 4C
*Range site:* Clayey

## PrE—Pierre clay, 6 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes
*Slope range:* 6 to 20 percent
*Major use:* Rangeland

### *Composition*

Pierre soil and similar soils: 85 percent
Contrasting inclusions:
Bufton soils—0 to 5 percent
Kyle soils—0 to 5 percent
Samsil soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 3 inches—olive, very firm, calcareous clay

*Subsoil:*
3 to 20 inches—grayish brown, very firm, calcareous clay
20 to 29 inches—light brownish gray, very firm, calcareous clay
29 to 32 inches—light brownish gray, calcareous clay that has about 14 percent fragments of soft shale, by volume

*Substratum:*
32 to 60 inches—light brownish gray shale

### *Soil Properties and Qualities*

*Depth to paralithic contact:* 20 to 40 inches (mainly 32 inches)
*Potential rooting depth:* 20 to 40 inches
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (3.76 inches)
*Permeability:* Very slow (less than 0.06 inch/hour) above paralithic contact
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate
*Distinctive properties:* Some areas have many scattered fragments of chalcedony. In some areas the substratum has 5 to 35 percent fragments of soft shale, by volume.

### *Inclusions*

*Contrasting inclusions:*
• Bufton soils, which have less clay than the Pierre soil, are more than 40 inches deep over shale, and are in landscape positions similar to those of the Pierre soil
• Kyle soils, which are more than 40 inches deep over shale and are lower on the landscape than the Pierre soil
• Samsil soils, which are less than 20 inches deep over shale and are higher on the landscape than the Pierre soil

*Similar inclusions:*
• Soils that have a surface layer of silty clay loam or silty clay

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Planting the trees on the contour helps to control water erosion and conserves soil moisture.
• Light cultivation and supplemental watering can close

the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material helps to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the depth to bedrock and the very slow permeability.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-4
*Windbreak suitability group:* 4C
*Range site:* Clayey

## PsD—Ponderosa loamy very fine sand, 6 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Foot slopes
*Slope range:* 6 to 9 percent (mainly 8 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Ponderosa soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Oglala soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 9 inches—dark grayish brown, very friable loamy very fine sand

*Subsurface layer:*
9 to 18 inches—grayish brown, very friable loamy very fine sand

*Transitional layer:*
18 to 28 inches—light brownish gray, very friable loamy very fine sand

*Substratum:*
28 to 60 inches—light brownish gray, calcareous loamy very fine sand that has 3 percent sandstone gravel fragments, by volume

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.50 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Bridget soils, which contain more silt and less clay than the Ponderosa soil and are on similar landscapes
• Oglala soils, which contain more silt and less clay than the Ponderosa soil, have calcareous sandstone at a depth of 40 to 60 inches, and are on knobs above the Ponderosa soil

*Similar inclusions:*
• Soils that have a dark surface layer that is more than 20 inches thick
• Soils that have a surface layer of very fine sandy loam

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• A sprinkler system is the best method of irrigation because the rate of water infiltration is too high for furrow irrigation.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## PsE—Ponderosa loamy very fine sand, 9 to 20 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Back slopes and foot slopes
*Slope range:* 9 to 20 percent (mainly 12 percent)
*Major use:* Rangeland

### *Composition*

Ponderosa soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Busher soils—0 to 5 percent
Tassel soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 10 inches—dark grayish brown, very friable loamy very fine sand

*Subsurface layer:*
10 to 19 inches—dark grayish brown, very friable loamy very fine sand

*Transitional layer:*
19 to 29 inches—grayish brown, very friable loamy very fine sand

*Substratum:*
29 to 49 inches—pale brown loamy very fine sand
49 to 60 inches—light brownish gray, calcareous loamy very fine sand that has 2 percent sandstone gravel fragments, by volume

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Bridget soils, which have more silt and less sand in the subsoil than the Ponderosa soil and are on similar landscapes
- Busher soils, which have calcareous sandstone bedrock at a depth of 40 to 60 inches and are on knolls above the Ponderosa soil
- Tassel soils, which have calcareous sandstone bedrock at a depth of 6 to 20 inches and are on ridges and knolls above the Ponderosa soil

*Similar inclusions:*
- Soils that are dark to a depth of more than 20 inches
- Soils that are very fine sandy loam throughout
- Soils that have a dark surface layer that is less than 7 inches thick

### *Use and Management*

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the slope

*Management measures:*
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5
*Windbreak suitability group:* 5
*Range site:* Sandy

## PtF—Ponderosa-Tassel-Vetal complex, 6 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Ponderosa—back slopes; Tassel—summits and shoulders; Vetal—foot slopes
*Slope range:* Ponderosa—6 to 30 percent (mainly 25 percent); Tassel—6 to 30 percent (mainly 28 percent); Vetal—6 to 9 percent (mainly 8 percent)
*Major use:* Rangeland

### *Composition*

Ponderosa soil and similar soils: 58 percent (plus or minus 10 percent)
Tassel soil and similar soils: 20 percent (plus or minus 10 percent)
Vetal soil and similar soils: 13 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 2 percent
Busher soils—0 to 5 percent
Oglala soils—0 to 2 percent
Rock outcrop—0 to 5 percent

### *Typical Profile*

**Ponderosa**

*Surface layer:*
0 to 10 inches—grayish brown, very friable loamy very fine sand

*Subsurface layer:*
10 to 19 inches—grayish brown, very friable loamy very fine sand

*Transitional layer:*
19 to 32 inches—pale brown, very friable loamy very fine sand

*Substratum:*
32 to 60 inches—very pale brown loamy very fine sand

**Tassel**

*Surface layer:*
0 to 5 inches—grayish brown, very friable loamy very fine sand

*Substratum:*
5 to 15 inches—light brownish gray, calcareous loamy very fine sand
15 to 60 inches—light gray, calcareous sandstone

**Vetal**

*Surface layer:*
0 to 19 inches—dark grayish brown, very friable very fine sandy loam

*Subsurface layer:*
19 to 30 inches—brown, very friable very fine sandy loam

*Substratum:*
30 to 60 inches—brown, very friable very fine sandy loam

### *Soil Properties and Qualities*

**Ponderosa**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 15 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.50 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Vetal**

*Potential rooting depth:* More than 60 inches
*Content of organic matter:* Moderate (2 to 3 percent)

*Drainage class:* Well drained
*Available water capacity:* High (10.5 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

## Inclusions

*Contrasting inclusions:*
• Bridget soils, which have more silt and less sand than the Ponderosa, Tassel, and Vetal soils and are lower on the landscape
• Busher soils, which have sandstone at a depth of 40 to 60 inches and are on landscapes similar to those of the Ponderosa, Tassel, and Vetal soils
• Oglala soils, which have sandstone at a depth of 40 to 60 inches, contain more silt than the Ponderosa, Tassel, and Vetal soils, and are in similar positions on the landscape
• Rock outcrop on hilltops and steep side slopes

*Inclusions similar to the Ponderosa soil:*
• Soils that have a dark surface layer that is more than 20 inches thick
• Soils that have a texture of very fine sandy loam
• Soils that have a thin, light colored surface layer

*Inclusions similar to the Tassel soil:*
• Soils that are leached to bedrock
• Soils that have a texture of very fine sandy loam

## Use and Management

### Cultivated crops

*Suitability:* Not suited

### Rangeland and hay

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

### Windbreaks

*Suitability:* Vetal—suited; Ponderosa and Tassel—generally not suited
• The Ponderosa and Tassel soils have one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify areas that are suitable for planting.

*Vetal*

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

### Dwellings

*Suitability:* Suited only in areas where the slope is less than 15 percent
• Onsite investigation is needed to identify the best suited areas.

*Ponderosa*

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

*Tassel*

*Management concerns:* Severe limitations because of the slope and the depth to bedrock
*Management measures:*
• The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

*Vetal*

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### Septic tank absorption fields

*Suitability:* Ponderosa and Vetal—suited only in areas where the slope is less than 15 percent; Tassel—not suited because of the depth to bedrock
• Onsite investigation is needed to identify the best suited areas.

*Ponderosa*

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly.

*Vetal*

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Ponderosa—VIe-5, dryland; Tassel—VIs-4, dryland; Vetal—IVe-5, dryland
*Windbreak suitability group:* Ponderosa—10; Tassel—10; Vetal—5
*Range site:* Ponderosa—Sandy; Tassel—Shallow Limy; Vetal—Sandy

## RkG—Rock outcrop-Tassel complex, 9 to 70 percent slopes

### Setting

*Landform:* Hillslopes (fig. 14)
*Position on the landform:* Rock outcrop—summits and shoulders; Tassel—back slopes
*Slope range:* Rock outcrop—9 to 70 percent; Tassel—9 to 70 percent (mainly 28 percent)
*Major use:* Rangeland

### Composition

Rock outcrop: 50 percent (plus or minus 15 percent)
Tassel soil and similar soils: 35 percent (plus or minus 15 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Sarben soils—0 to 5 percent
Valent soils—0 to 5 percent

### Typical Profile

**Tassel**

*Surface layer:*
0 to 6 inches—light brownish gray, very friable loamy fine sand

*Substratum:*
6 to 16 inches—light gray, very friable loamy very fine sand
16 to 60 inches—white, calcareous sandstone

### Soil Properties and Qualities

**Rock outcrop**

*Depth to paralithic contact:* 0 inches
*Potential rooting depth:* 0 inches
*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Sandstone
*Surface runoff:* Very rapid

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 16 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 16 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.68 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Very severe
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Busher soils, which have a dark surface layer, are 40 to 60 inches deep over bedrock, and are on the lower parts of the landscape
- Sarben soils, which are more than 60 inches deep over bedrock and are on the lower parts of the landscape
- Valent soils, which are more than 60 inches deep over bedrock, are sandy, and are on the lower parts of the landscape

*Inclusions similar to the Tassel soil:*
- Soils that have a surface layer of loamy fine sand

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Suitability:*
- A suitable alternative site is needed because of the slope and the depth to bedrock.

**Septic tank absorption fields**

*Suitability:*
- A suitable alternative site is needed because of the slope and the depth to bedrock.

**Figure 14.—An area of Rock outcrop-Tassel complex, 9 to 70 percent slopes.**

### *Interpretive Groups*

*Land capability classification:* Rock outcrop—VIIIs-8; Tassel—VIs-4, dryland
*Windbreak suitability group:* Rock outcrop—10; Tassel—10
*Range site:* Rock outcrop—none; Tassel—Shallow Limy

## SbF—Samsil-Pierre complex, 3 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Samsil—summits and shoulders; Pierre—back slopes
*Slope range:* Samsil—3 to 30 percent (mainly 20 percent); Pierre—3 to 20 percent (mainly 10 percent)
*Major use:* Rangeland

### *Composition*

Samsil soil and similar soils: 70 percent (plus or minus 5 percent)
Pierre soil and similar soils: 20 percent (plus or minus 5 percent)
Contrasting inclusions:
Kyle soils—0 to 4 percent
Bufton soils—0 to 4 percent
Shale outcrop—0 to 2 percent

### *Typical Profile*

**Samsil**

*Surface layer:*
0 to 3 inches—grayish brown, very firm clay

*Transitional layer:*
3 to 9 inches—light brownish gray, very firm, calcareous clay

*Substratum:*
9 to 18 inches—light brownish gray, calcareous clay that has about 8 percent fragments of soft shale, by volume
18 to 60 inches—grayish brown, calcareous shale

**Pierre**

*Surface layer:*
0 to 4 inches—grayish brown, very firm, calcareous clay

*Subsoil:*
4 to 13 inches—grayish brown, very firm, calcareous clay

13 to 26 inches—light brownish gray, very firm, calcareous clay

*Substratum:*
26 to 32 inches—light brownish gray, calcareous clay that has about 10 percent fragments of soft shale, by volume
32 to 60 inches—light brownish gray, calcareous shale

## Soil Properties and Qualities

### Samsil

*Depth to paralithic contact:* 6 to 20 inches (mainly 18 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 18 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.46 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

### Pierre

*Depth to paralithic contact:* 20 to 40 inches (mainly 32 inches)
*Potential rooting depth:* 20 to 40 inches (mainly 32 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Low (4.32 inches)
*Permeability:* Very slow (0.0 to 0.06 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

## Inclusions

*Contrasting inclusions:*
- Kyle soils, which are deep and are on foot slopes
- Bufton soils, which are deep, have less clay than the Samsil and Pierre soils, and are lower on the landscape
- Shale outcrops, which are on hilltops and steep side slopes

*Inclusions similar to the Samsil soil:*
- Soils in which carbonates are leached below a depth of 10 inches
- Soils that have a surface layer of silty clay loam

*Inclusions similar to the Pierre soil:*
- Soils in which carbonates are leached from the top few inches
- Soils that have a surface layer of silty clay loam or silty clay

## Use and Management

### Cultivated crops

*Suitability:* Not suited

### Rangeland and hay

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

### Windbreaks

*Suitability:* Samsil—not suited; Pierre—suited
- The Samsil soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

*Pierre*

*Management measures:*
- Planting the trees on the contour helps to control water erosion and conserves soil moisture.
- Light cultivation and supplemental watering can close the cracks caused by shrinking and swelling of the soil and thus help to protect the roots from exposure.

### Dwellings

*Management concerns:* Severe limitations because of the slope and the shrink-swell potential
*Management measures:*
- Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.
- Grading helps to keep surface runoff away from the buildings.

### Septic tank absorption fields

*Suitability:*
- A suitable alternative site is needed because of the depth to bedrock, the slow permeability, and the slope

## Interpretive Groups

*Land capability classification:* Samsil—VIs-4, dryland; Pierre—VIe-4, dryland
*Windbreak suitability group:* Samsil—10; Pierre—4C
*Range site:* Samsil—Shallow Clay; Pierre—Clayey

## ScG—Samsil-Rock outcrop complex, 9 to 50 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Samsil—back slopes; Rock outcrop—summits and shoulders
*Slope range:* Samsil—9 to 50 percent (mainly 26 percent); Rock outcrop—9 to 50 percent
*Major use:* Rangeland

### Composition

Samsil soil and similar soils: 70 percent (plus or minus 5 percent)
Rock outcrop: 20 percent (plus or minus 5 percent)
Contrasting inclusions:
Pierre soils—0 to 10 percent

### Typical Profile

**Samsil**

*Surface layer:*
0 to 4 inches—grayish brown, very firm clay

*Transitional layer:*
4 to 12 inches—gray, very firm, calcareous clay that has about 30 percent fragments of shale, by volume

*Underlying material*
12 to 60 inches—gray, calcareous shale

### Soil Properties and Qualities

**Samsil**

*Depth to paralithic contact:* 6 to 20 inches (mainly 12 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 12 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (1.72 inches)
*Permeability:* Slow (0.06 to 0.2 inch/hour)
*Parent material:* Residuum weathered from shale
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Severe

**Rock outcrop**

*Depth to paralithic contact:* 0 inches
*Potential rooting depth:* 0 inches
*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Unweathered shale
*Surface runoff:* Very rapid

### Inclusions

*Contrasting inclusions:*
• Pierre soils, which have shale at a depth of 20 to 40 inches and are on the lower parts of the landscape

*Inclusions similar to the Samsil soil:*
• Soils that have a surface layer of silty clay

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the slope and the shrink-swell potential

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the depth to bedrock, the slow permeability, and the slope

### Interpretive Groups

*Land capability classification:* Samsil—VIs-4, dryland; Rock outcrop—VIIIs-8
*Windbreak suitability group:* Samsil—10; Rock outcrop—10
*Range site:* Samsil—Shallow Clay; Rock outcrop—none

## SdD—Sarben loamy very fine sand, 3 to 9 percent slopes

### Setting

*Landform:* Hillslopes
*Slope range:* 3 to 9 percent (mainly 5 percent)
*Major uses:* Cropland and rangeland

### Composition

Sarben soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent

Valent soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—brown, very friable loamy very fine sand

*Transitional layer:*
4 to 10 inches—brown, very friable loamy very fine sand

*Substratum:*
10 to 60 inches—pale brown loamy very fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
- Busher soils, which have sandstone bedrock at a depth of 40 to 60 inches and are on landscapes similar to those of the Sarben soil
- Valent soils, which have more sand and less silt than the Sarben soil and are on similar landscapes

*Similar inclusions:*
- Soils that have carbonates within a depth of 15 inches
- Soils that have a dark surface layer

### Use and Management

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Terraces, contour farming, and grassed waterways help to control water erosion.
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.
- A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## SdF—Sarben loamy very fine sand, 9 to 30 percent slopes

### Setting

*Landform:* Hillslopes
*Slope range:* 9 to 30 percent (mainly 14 percent)
*Major use:* Rangeland

### Composition

Sarben soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent

Tassel soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, very friable loamy very fine sand

*Substratum:*
4 to 21 inches—grayish brown loamy very fine sand
21 to 60 inches—pale brown loamy very fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.52 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Busher soils, which have sandstone bedrock at a depth of 40 to 60 inches and are on landscapes similar to those of the Sarben soil
- Tassel soils, which have bedrock at a depth of 6 to 20 inches and are on knobs on the high parts of the landscape
- Valent soils, which contain more sand and less silt than the Sarben soil and are on similar landscapes

*Similar inclusions:*
- Soils that have lime within a depth of 15 inches

### *Use and Management*

**Rangeland and hay**

*Management measures:*
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
- This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

**Dwellings**

*Management concerns:* A severe limitation because of the slope
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of the slope
*Management measures:*
- Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5
*Windbreak suitability group:* 10
*Range site:* Sandy

## SeB—Sarben-Busher complex, 0 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Sarben and Busher—summits
*Slope range:* Sarben—0 to 3 percent (mainly 2 percent); Busher—0 to 3 percent (mainly 3 percent)
*Major uses:* Rangeland and cropland

### *Composition*

Sarben soil and similar soils: 55 percent (plus or minus 10 percent)
Busher soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
Tassel soils—0 to 5 percent
Valent soils—0 to 5 percent
Vetal soils—0 to 5 percent

### *Typical Profile*

**Sarben**

*Surface layer:*
0 to 7 inches—light brownish gray, very friable loamy very fine sand

*Transitional layer:*
7 to 10 inches—light brownish gray, loose loamy very fine sand

*Substratum:*
10 to 33 inches—pale brown, loose loamy very fine sand
33 to 60 inches—light gray, calcareous loamy very fine sand

**Busher**

*Surface layer:*
0 to 7 inches—brown, very friable loamy very fine sand

*Subsoil:*
7 to 13 inches—brown, very friable loamy very fine sand

*Substratum:*
13 to 20 inches—brown, loose loamy very fine sand
20 to 44 inches—pale brown, loose, calcareous loamy very fine sand
44 to 60 inches—very pale brown, calcareous sandstone

## *Soil Properties and Qualities*

**Sarben**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.5 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

**Busher**

*Depth to paralithic contact:* 40 to 60 inches (mainly 40 inches)
*Potential rooting depth:* Deep (40 to 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.5 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

## *Inclusions*

*Contrasting inclusions:*
- Tassel soils, which have calcareous sandstone at a depth of 6 to 20 inches and are on knobs above the Sarben and Busher soils
- Valent soils, which are sandy, are 60 or more inches deep over bedrock, and are on the slightly higher parts of the landscape
- Vetal soils, which have a surface layer that is more than 20 inches thick, are 60 or more inches deep over bedrock, and are in low areas

*Inclusions similar to the Sarben soil:*
- Soils that are very fine sandy loam throughout and have lime within a depth of 20 inches

*Inclusions similar to the Busher soil:*
- Soils that are very fine sandy loam throughout

## *Use and Management*

**Cultivated crops**

*Management measures:*
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Close-growing crops, a protective cover of crop residue, and winter cover crops help to control soil blowing.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Sarben*

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

*Busher*

*Management concerns:* A moderate limitation because of the depth to bedrock
*Management measures:*
- Fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

## *Interpretive Groups*

*Land capability classification:* Sarben—IIIe-3, dryland, and IIIe-10, irrigated; Busher—IIIe-5, dryland, and IIIe-10, irrigated

*Windbreak suitability group:* Sarben and Busher—5
*Range site:* Sarben and Busher—Sandy
*Irrigation design group:* Sarben and Busher—10

## SeD—Sarben-Busher complex, 3 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Sarben—summits and shoulders; Busher—back slopes and foot slopes
*Slope range:* Sarben—3 to 9 percent (mainly 6 percent); Busher—3 to 9 percent (mainly 7 percent)
*Major uses:* Rangeland and cropland

### *Composition*

Sarben soil and similar soils: 55 percent (plus or minus 7 percent)
Busher soil and similar soils: 30 percent (plus or minus 5 percent)
Contrasting inclusions:
Tassel soils—0 to 10 percent
Valent soils—0 to 5 percent

### *Typical Profile*

**Sarben**

*Surface layer:*
0 to 6 inches—light brownish gray, very friable loamy very fine sand

*Substratum:*
6 to 25 inches—pale brown, loose loamy very fine sand
25 to 60 inches—pale brown, loose, calcareous loamy very fine sand

**Busher**

*Surface layer:*
0 to 8 inches—grayish brown, very friable loamy very fine sand

*Subsoil:*
8 to 19 inches—light brownish gray, very friable loamy very fine sand

*Substratum:*
19 to 37 inches—pale brown, loose loamy very fine sand
37 to 49 inches—very pale brown, loose, calcareous loamy very fine sand
49 to 60 inches—very pale brown, calcareous sandstone

### *Soil Properties and Qualities*

**Sarben**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.5 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Loamy and sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

**Busher**

*Depth to paralithic contact:* 40 to 60 inches (mainly 42 inches)
*Depth to unconsolidated material that has rock fragments:* 20 to 40 inches (mainly 30 inches)
*Potential rooting depth:* Deep (40 to 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.3 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour) above paralithic contact
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
- Tassel soils, which have calcareous sandstone at a depth of 6 to 20 inches and are on knobs above the Sarben and Busher soils
- Valent soils, which are sandy, are 60 or more inches deep over bedrock, and are on the slightly higher parts of the landscape

*Inclusions similar to the Sarben soil:*
- Soils that are very fine sandy loam throughout and have lime within a depth of 20 inches
- Soils that have a thicker and darker surface layer

*Inclusions similar to the Busher soil:*
- Soils that are very fine sandy loam throughout

### *Use and Management*

**Cultivated crops**

*Management measures:*
- A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
- Conservation tillage practices, such as disking and chiseling, keep crop residue on the surface and thus help to control soil blowing and conserve soil moisture.
- Soil blowing can be controlled by stripcropping, stubble

mulch tillage, and a cropping system that keeps crop residue on the surface.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Sarben*

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

*Busher*

*Management concerns:* A moderate limitation because of the depth to bedrock
*Management measures:*
• Fill material can raise the absorption field a sufficient distance above the sandstone bedrock.

### *Interpretive Groups*

*Land capability classification:* Sarben and Busher—IVe-3, dryland, and IVe-10, irrigated
*Windbreak suitability group:* Sarben and Busher—5
*Range site:* Sarben and Busher—Sandy
*Irrigation design group:* Sarben and Busher—8

## SfB—Satanta very fine sandy loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Satanta soil and similar soils: 85 percent (plus or minus 10 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Jayem soils—0 to 5 percent
Keith soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—grayish brown, very friable very fine sandy loam

*Subsoil:*
8 to 16 inches—brown, friable sandy clay loam
16 to 26 inches—brown, friable loam
26 to 39 inches—light gray, calcareous, very friable very fine sandy loam

*Substratum:*
39 to 60 inches—light gray, calcareous loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.67 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Busher soils, which have more sand in the subsoil than the Satanta soil and are 40 to 60 inches deep over calcareous sandstone
• Jayem soils, which have more sand and less clay in the subsoil than the Satanta soil and are on the slightly higher parts of the landscape
• Keith soils, which have less sand in the subsoil than the Satanta soil and are in about the same landscape positions

*Similar inclusions:*
• Areas where the dark surface layer is less than 7 inches thick
• Areas where the surface layer is loamy very fine sand or fine sandy loam
• Areas where the subsoil has less clay

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Management concerns:* A moderate limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIe-3; irrigated—IIe-5
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 5

## SfC—Satanta very fine sandy loam, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Slope range:* 3 to 6 percent (mainly 5 percent)
*Major uses:* Cropland and rangeland

### Composition

Satanta soil and similar soils: 85 percent (plus or minus 10 percent)
Contrasting inclusions:
Busher soils—0 to 5 percent
Jayem soils—0 to 5 percent
Keith soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable very fine sandy loam

*Subsoil:*
8 to 14 inches—dark grayish brown, friable clay loam
14 to 26 inches—brown, friable loam
26 to 39 inches—pale brown, calcareous, friable loam

*Substratum:*
39 to 60 inches—very pale brown, calcareous loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.88 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
• Busher soils, which have more sand in the subsoil than the Satanta soil and are 40 to 60 inches deep over sandstone
• Jayem soils, which have more sand and less clay in the subsoil than the Satanta soil and are on the slightly higher parts of the landscape
• Keith soils, which have less sand in the subsoil than the Satanta soil and are in about the same landscape positions

*Similar inclusions:*
• Some areas where the dark surface layer is less than 7 inches thick
• Some areas where the surface layer is loamy very fine sand or fine sandy loam
• Some areas where the subsoil has less clay

### Use and Management

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and water erosion.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
• Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A moderate limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### Interpretive Groups

*Land capability classification:* Dryland—IIIe-3; irrigated—IIIe-5
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 5

## Sg—Savo silty clay loam, 0 to 2 percent slopes

### Setting

*Landform:* Stream terraces
*Slope range:* 0 to 2 percent (mainly 1 percent)
*Major use:* Cropland

### Composition

Savo soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Kyle soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—grayish brown, friable silty clay loam

*Subsoil:*
4 to 10 inches—grayish brown, firm silty clay loam
10 to 20 inches—grayish brown, firm silty clay
20 to 27 inches—light olive brown, firm, calcareous silty clay loam

*Substratum:*
27 to 40 inches—light brownish gray, calcareous silty clay loam
40 to 60 inches—light gray, calcareous silty clay loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.93 inches)
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)
*Parent material:* Loamy and clayey sediments
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Slight

### Inclusions

*Contrasting inclusions:*
• Arvada soils, which are high in content of sodium and are on landscapes similar to those of the Savo soil
• Kyle soils, which have more clay than the Savo soil, do not have a dark surface soil, and are on landscapes similar to those of the Savo soil

*Similar inclusions:*
• Some areas where the surface layer is thinner and lighter colored

• Some areas where the surface layer is silt loam or loam
• Some areas where the surface layer is dark to a depth of more than 20 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
• Weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicide.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of the moderately slow permeability
*Management measures:*
• The moderately slow permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIc-1; irrigated—I-3
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 3

## SgC—Savo silty clay loam, 2 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Slope range:* 2 to 6 percent (mainly 3 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Savo soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Bufton soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—grayish brown, friable silty clay loam

*Subsoil:*
4 to 9 inches—dark grayish brown, friable silty clay loam
9 to 15 inches—grayish brown, firm silty clay loam
15 to 22 inches—light brownish gray, firm, calcareous silty clay loam

*Substratum:*
22 to 60 inches—light gray, calcareous silty clay loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.41 inches)
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)
*Parent material:* Silty sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Slight

### *Inclusions*

*Contrasting inclusions:*
• Arvada soils, which are high in content of sodium and are in landscape positions similar to those of the Savo soil
• Bufton soils, which do not have a dark surface soil and are in landscape positions similar to those of the Savo soil

*Similar inclusions:*
• Areas where the surface layer is silt loam or loam
• Areas where the dark surface soil is less than 7 inches thick and the subsoil contains less clay

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control water erosion and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control water erosion and soil blowing.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of applying irrigation water.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Management concerns:* A severe limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of the moderately slow permeability
*Management measures:*
• The moderately slow permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIe-1; irrigated—IIe-3
*Windbreak suitability group:* 3
*Range site:* Silty

## SrF—Schamber gravelly sandy loam, 3 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Summits and back slopes
*Slope range:* 3 to 30 percent (mainly 18 percent)
*Major use:* Rangeland

### *Composition*

Schamber soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Epping soils—0 to 2 percent
Norrest soils—0 to 2 percent
Orella soils—0 to 2 percent
Pierre soils—0 to 2 percent
Samsil soils—0 to 2 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—light yellowish brown, friable, calcareous gravelly sandy loam

*Substratum:*
4 to 9 inches—very pale brown, loose, calcareous gravelly coarse sand
9 to 60 inches—very pale brown, calcareous very gravelly coarse sand

### *Soil Properties and Qualities*

*Depth to unconsolidated material that has rock fragments:* 4 to 10 inches (mainly 4 inches)
*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Very low (2.28 inches)
*Permeability:* Very rapid (more than 20 inches/hour)
*Parent material:* Gravelly outwash sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Slight

### *Inclusions*

*Contrasting inclusions:*
• Epping soils, which have siltstone at a depth of 10 to 20 inches and are on landscapes similar to those of the Schamber soil
• Norrest soils, which are moderately deep over silty

shale and are on landscapes similar to those of the Schamber soil
• Orella soils, which are high in content of sodium, have shale at a depth of 10 to 20 inches, and are on landscapes similar to those of the Schamber soil
• Pierre and Samsil soils, which contain more clay than the Schamber soil and are on similar landscapes
• Soils that have a surface layer of loamy sand

*Similar inclusions:*
• Soils that have a surface layer of sandy loam

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Not suited

**Dwellings**

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Buildings should be designed so that they conform to the natural slope of the land, or the soil should be graded.

**Septic tank absorption fields**

*Management concerns:* Severe limitations because of a poor filtering capacity and the slope
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIs-4
*Windbreak suitability group:* 10
*Range site:* Shallow to Gravel

## Ss—Scoville fine sand, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Irrigated cropland

### *Composition*

Scoville soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent
Sarben soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—brown, loose fine sand

*Transitional layer:*
8 to 15 inches—yellowish brown, loose fine sand

*Substratum:*
15 to 49 inches—light yellowish brown loamy fine sand
49 to 60 inches—light gray, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Moderate (6.31 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the upper part of the profile, moderate (0.6 inch to 2.0 inches/hour) in the 2C horizon
*Parent material:* Sandy alluvium over loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A loamy buried layer at a depth of 35 to 55 inches

### *Inclusions*

*Contrasting inclusions:*
• Alice soils, which have a dark surface soil that is more than 7 inches thick and are in landscape positions similar to those of the Scoville soil
• Sarben soils, which contain more silt and less sand than the Scoville soil and are in similar landscape positions
• Valent soils, which do not have a 2C horizon and are higher on the landscape than the Scoville soil

*Similar inclusions:*
- Some areas where the surface layer is darker and thicker than is typical and is loamy fine sand
- Some areas where the loamy 2C horizon is at a depth of 20 to 40 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.

**Windbreaks**

*Management measures:*
- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

*Management measures:*
- Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-10
*Windbreak suitability group:* 7
*Range site:* Sandy
*Irrigation design group:* 10

## SsB—Scoville fine sand, 1 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Irrigated cropland

### *Composition*

Scoville soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent
Sarben soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—brown, loose fine sand

*Transitional layer:*
8 to 16 inches—brown, loose fine sand

*Substratum:*
16 to 47 inches—pale brown fine sand
47 to 60 inches—very pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Moderate (6.44 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the upper part of the profile, moderate (0.6 inch to 2.0 inches/hour) in the 2C horizon
*Parent material:* Sandy alluvium over loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A loamy buried layer at a depth of 35 to 55 inches

### *Inclusions*

*Contrasting inclusions:*
- Alice and Sarben soils, which contain more silt and less sand than the Scoville soil and are in similar positions on the landscape
- Valent soils, which do not have a 2C horizon and are higher on the landscape than the Scoville soil

*Similar inclusions:*
- Some areas where the surface layer is darker than is typical and is loamy fine sand
- Some areas where the 2C horizon is as shallow as 35 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
- A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

*Management measures:*
- Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-10
*Windbreak suitability group:* 7
*Range site:* Sandy
*Irrigation design group:* 10

## Su—Scoville loamy fine sand, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Irrigated cropland

### *Composition*

Scoville soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent
Sarben soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—brown, very friable loamy fine sand

*Transitional layer:*
6 to 16 inches—brown, loose fine sand

*Substratum:*
16 to 36 inches—brown fine sand
36 to 60 inches—light brownish gray, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Moderate (7.50 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the upper part of the profile, moderate (0.6 inch to 2.0 inches/hour) in the 2C horizon
*Parent material:* Sandy alluvium over loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A loamy buried layer at a depth of 35 to 55 inches

### *Inclusions*

*Contrasting inclusions:*
- Alice and Sarben soils, which contain more silt and less sand than the Scoville soil and are in similar positions on the landscape
- Valent soils, which do not have a 2C horizon and are higher on the landscape than the Scoville soil

*Similar inclusions:*
- Some areas where the surface layer is thicker and darker than is typical

• Some areas where the 2C horizon is below a depth of 60 inches and the surface layer is fine sand

### *Use and Management*

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## SuB—Scoville loamy fine sand, 1 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Irrigated cropland

### *Composition*

Scoville soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent
Sarben soils—0 to 5 percent
Valent soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 9 inches—brown, very friable loamy fine sand

*Transitional layer:*
9 to 20 inches—brown, very friable loamy fine sand

*Substratum:*
20 to 38 inches—light yellowish brown loamy fine sand
38 to 44 inches—light gray, calcareous very fine sandy loam
44 to 60 inches—pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat excessively drained
*Available water capacity:* Moderate (7.64 inches)
*Permeability:* Rapid (6 to 20 inches/hour) in the upper part of the profile, moderate (0.6 inch to 2.0 inches/hour) in the 2C horizon
*Parent material:* Sandy alluvium over loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A loamy buried layer at a depth of 35 to 55 inches

### *Inclusions*

*Contrasting inclusions:*
• Alice and Sarben soils, which contain more silt and less sand than the Scoville soil and are in similar positions on the landscape

• Valent soils, which do not have a loamy 2C horizon and are higher on the landscape than the Scoville soil

*Similar inclusions:*
• Some areas where the surface layer is thicker and darker than is typical
• Some areas where the loamy 2C horizon is below a depth of 60 inches and the surface layer is fine sand

### *Use and Management*

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-5; irrigated—IVe-10
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 10

## SxE—Skilak silty clay loam, 6 to 20 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 6 to 20 percent (mainly 13 percent)
*Major use:* Rangeland

### *Composition*

Skilak soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Arvada soils—0 to 5 percent
Badland—0 to 5 percent
Interior soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 3 inches—light gray, friable, calcareous, moderately alkaline silty clay loam

*Transitional layer:*
3 to 8 inches—light gray, friable, calcareous, moderately alkaline silt loam

*Substratum:*
8 to 60 inches—light gray, calcareous, strongly alkaline silt loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.67 inches)
*Permeability:* Moderate (0.6 to 2.0 inch/hour)
*Parent material:* Silty alluvium
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Arvada soils, which contain more clay than the Skilak soil and are on the less sloping parts of the landscape
• Badland, which consists of barren exposures of eroding shale and siltstone and is on the steepest parts of the landscape
• Interior soils, which are in narrow drainageways on the lowest parts of the landscape, are frequently flooded, and are stratified

*Similar inclusions:*
• Some areas where the surface soil and underlying material are loam or clay loam

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.
• If an area is reseeded, the species selected for planting should be those that are suited to a saline or alkali soil.
• Careful management is needed in very strongly alkaline areas, which support little or no vegetation and are subject to severe soil blowing during dry periods.

**Windbreaks**

*Management measures:*
• Only those species that can tolerate a high content of calcium should be selected for planting.

**Dwellings**

*Management concerns:* Moderate limitations because of the shrink-swell potential and the slope
*Management measures:*
• Grading helps to keep surface runoff away from the buildings.
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the slope
*Management measures:*
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

### Interpretive Groups

*Land capability classification:* Dryland—VIe-1
*Windbreak suitability group:* 8
*Range site:* Limy Upland

## TbG—Tassel-Ashollow-Rock outcrop complex, 9 to 60 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Tassel—summits and shoulders; Ashollow—back slopes, foot slopes, and toe slopes; Rock outcrop—summits
*Slope range:* Tassel—20 to 60 percent (mainly 50 percent); Ashollow—9 to 30 percent (mainly 25 percent); Rock outcrop—25 to 60 percent (mainly 50 percent)
*Major uses:* Rangeland and wildlife habitat

### Composition

Tassel soil and similar soils: 50 percent (plus or minus 10 percent)
Ashollow soil and similar soils: 25 percent (plus or minus 10 percent)
Rock outcrop: 20 percent (plus or minus 10 percent)
Contrasting inclusions:
Valent soils—0 to 5 percent

### Typical Profile

**Tassel**

*Surface layer:*
0 to 7 inches—grayish brown, very friable, calcareous loamy very fine sand

*Substratum:*
7 to 13 inches—pale brown, calcareous loamy very fine sand
13 to 60 inches—very pale brown, calcareous sandstone

**Ashollow**

*Surface layer:*
0 to 6 inches—grayish brown, very friable, calcareous loamy very fine sand

*Transitional layer:*
6 to 15 inches—light brownish gray, very friable, calcareous loamy very fine sand

*Substratum:*
15 to 40 inches—light brownish gray, calcareous loamy very fine sand
40 to 60 inches—light gray, calcareous loamy very fine sand

### Soil Properties and Qualities

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 13 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 13 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.36 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Ashollow**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.68 inches)
*Permeability:* Moderately rapid
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe
*Distinctive property:* 1 to 4 percent calcium carbonates in the substratum

**Rock outcrop**

*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Calcareous sandstone
*Surface runoff:* Very rapid

### *Inclusions*

*Contrasting inclusions:*
• Valent soils, which contain more sand than the Ashollow soil and are in about the same landscape position

*Inclusions similar to the Ashollow soil:*
• Soils that are leached of carbonates in the upper 24 inches

### *Use and Management*

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the slope and the depth to bedrock.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the slope.

### *Interpretive Groups*

*Land capability classification:* Tassel—VIIs-4, dryland; Ashollow—VIe-5, dryland; Rock outcrop—VIIIs-8
*Windbreak suitability group:* Tassel—10; Ashollow—10; Rock outcrop—10
*Range site:* Tassel—Shallow Limy; Ashollow—Sandy; Rock outcrop—none

## TgF—Tassel-Busher-Rock outcrop complex, 6 to 30 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Tassel—shoulders and summits; Busher—back slopes and foot slopes; Rock outcrop—shoulders and summits
*Slope range:* Tassel—6 to 30 percent (mainly 25 percent); Busher—6 to 20 percent (mainly 15 percent); Rock outcrop—9 to 30 percent
*Major use:* Rangeland

### *Composition*

Tassel soil and similar soils: 45 percent (plus or minus 10 percent)
Busher soil and similar soils: 25 percent (plus or minus 10 percent)
Rock outcrop: 15 percent (plus or minus 5 percent)
Contrasting inclusions:
Jayem soils—0 to 5 percent
Vetal soils—0 to 5 percent
Ashollow soils—0 to 5 percent

### *Typical Profile*

**Tassel**

*Surface layer:*
0 to 3 inches—grayish brown, very friable loamy very fine sand

*Transitional layer:*
3 to 8 inches—light brownish gray, very friable, calcareous loamy very fine sand

*Substratum:*
8 to 15 inches—pale brown, calcareous loamy very fine sand that has 10 percent gravel-sized sandstone fragments, by volume
15 to 60 inches—light gray, calcareous sandstone

**Busher**

*Surface layer:*
0 to 7 inches—dark brown, very friable loamy very fine sand
7 to 18 inches—brown, very friable loamy very fine sand

*Subsoil:*
18 to 28 inches—brown, very friable loamy very fine sand

*Substratum:*
28 to 52 inches—pale brown, very friable loamy very fine sand that has 3 percent gravel-sized sandstone fragments, by volume
52 to 60 inches—very pale brown, calcareous sandstone

## Soil Properties and Qualities

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 15 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 15 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.52 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Busher**

*Depth to paralithic contact:* 40 to 60 inches (mainly 59 inches)
*Potential rooting depth:* 40 to 60 inches (mainly 59 inches)
*Content of organic matter:* Moderately low (1 to 2 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (8.44 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Rock outcrop**

*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Calcareous sandstone (fig. 15)
*Surface runoff:* Very rapid

## Inclusions

*Contrasting inclusions:*
- Jayem soils, which have bedrock below a depth of 60 inches and are in low areas
- Vetal soils, which have a thick, dark surface layer, have bedrock below a depth of 60 inches, and are in low areas
- Ashollow soils, which have a thin, light colored surface layer, have lime high in the profile, and are in low landscape positions similar to those of the Busher soil

*Inclusions similar to the Tassel soil:*
- Soils that have a dark surface layer of very fine sandy loam
- Soils that are leached of lime to bedrock

*Inclusions similar to the Busher soil:*
- Soils that have a surface layer of very fine sandy loam
- Soils that have a light colored surface layer

## Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
- Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Tassel and Rock outcrop—not suited; Busher—suited

*Busher*

*Management measures:*
- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Tassel*

*Management concerns:* Severe limitations because of the depth to bedrock and the slope
*Management measures:*
- Grading helps to keep surface runoff away from the buildings.
- Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock should be graded.
- The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings that have deep foundations.

**Figure 15.—Sandstone outcrop in an area of Tassel-Busher-Rock outcrop complex, 6 to 30 percent slopes.**

*Busher*

*Management concerns:* A moderate limitation because of the slope

*Management measures:*

- Grading helps to keep surface runoff away from the buildings.
- Buildings should be designed so that they conform to the natural slope of the land, or the soil and soft bedrock should be graded.

*Rock outcrop*

*Suitability:* Not suited

**Septic tank absorption fields**

*Suitability:* Busher—suited only in areas where the slope is less than 15 percent; Tassel and Rock outcrop—not suited because of the depth to bedrock

- Onsite investigation is needed to identify the best suited areas.

*Busher*

*Management concerns:* Moderate limitations because of the depth to bedrock and the slope

*Management measures:*

- Fill material can raise the absorption field a sufficient distance above the sandstone bedrock.
- Land shaping and installing the absorption field on the contour help to ensure that the system operates properly.

## *Interpretive Groups*

*Land capability classification:* Tassel—VIs-4, dryland; Busher—VIe-5, dryland; Rock outcrop—VIIIs-8

*Windbreak suitability group:* Tassel—10; Busher—7; Rock outcrop—10

*Range site:* Tassel—Shallow Limy; Busher—Sandy; Rock outcrop—none

## TrG—Tassel-Ponderosa-Rock outcrop association, 9 to 70 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Tassel—summits and shoulders; Ponderosa—back slopes, foot slopes, and toe slopes; Rock outcrop—summits and shoulders
*Slope range:* Tassel—9 to 70 percent (mainly 40 percent); Ponderosa—9 to 60 percent (mainly 25 percent); Rock outcrop—20 to 70 percent
*Major use:* Rangeland

### *Composition*

Tassel soil and similar soils: 47 percent (plus or minus 10 percent)
Ponderosa soil and similar soils: 26 percent (plus or minus 10 percent)
Rock outcrop: 18 percent (plus or minus 10 percent)
Contrasting inclusions:
Oglala soils—0 to 2 percent
Vetal soils—0 to 6 percent
Glenberg soils—0 to 1 percent

### *Typical Profile*

**Tassel**

*Surface layer:*
0 to 5 inches—grayish brown, very friable loamy very fine sand

*Transitional layer:*
5 to 12 inches—pale brown, very friable, calcareous loamy very fine sand

*Substratum:*
12 to 17 inches—light brownish gray, very friable, calcareous loamy very fine sand that has 3 percent gravel-sized sandstone fragments, by volume
17 to 60 inches—white, calcareous sandstone

**Ponderosa**

*Surface layer:*
0 to 8 inches—dark grayish brown, very friable loamy very fine sand
8 to 13 inches—dark brown, very friable loamy very fine sand

*Transitional layer:*
13 to 22 inches—brown, very friable loamy very fine sand

*Substratum:*
22 to 45 inches—brown, calcareous loamy very fine sand
45 to 60 inches—pale brown, calcareous loamy very fine sand that has 3 percent gravel-sized sandstone fragments, by volume

### *Soil Properties and Qualities*

**Tassel**

*Depth to paralithic contact:* 6 to 20 inches (mainly 17 inches)
*Potential rooting depth:* 6 to 20 inches (mainly 17 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Well drained
*Available water capacity:* Very low (2.84 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Residuum weathered from calcareous sandstone
*Surface runoff:* Very rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Ponderosa**

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* Moderate (7.78 inches)
*Permeability:* Moderately rapid (2 to 6 inches/hour)
*Parent material:* Sandy and loamy colluvium and residuum weathered from calcareous sandstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Very severe

**Rock outcrop**

*Permeability:* Very slow (less than 0.06 inch/hour)
*Kind of rock:* Sandstone
*Surface runoff:* Very rapid

### *Inclusions*

*Contrasting inclusions:*
- Oglala soils, which have bedrock at a depth of 40 to 60 inches and are on landscapes similar to those of the Tassel and Ponderosa soils
- Glenberg soils, which are stratified, are on creek bottoms, and are subject to flooding
- Vetal soils, which are deep, are in low swales or on foot slopes, and have a dark surface layer that is more than 20 inches thick

*Inclusions similar to the Ponderosa soil:*
- Soils that have carbonates within a depth of 15 inches
- Areas where the soil is very fine sandy loam throughout

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Suitability:* Generally not suited
• A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if the trees and shrubs are hand planted or if other special management is applied.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the slope and the depth to bedrock.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the slope and the depth to bedrock.

### Interpretive Groups

*Land capability classification:* Tassel—VIIs-4, dryland; Ponderosa—VIIe-5, dryland; Rock outcrop—VIIIs-8
*Windbreak suitability group:* Tassel—10; Ponderosa—10; Rock outcrop—10
*Range site:* Tassel—Shallow Limy; Ponderosa—Sandy; Rock outcrop—none

## TtB—Thirtynine loam, 1 to 3 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Summits
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### Composition

Thirtynine soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Mitchell soils—0 to 5 percent
Epping soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 8 inches—dark grayish brown, friable loam

*Subsoil:*
8 to 17 inches—brown, friable loam
17 to 22 inches—pale brown, friable, calcareous loam

*Substratum:*
22 to 29 inches—pale brown, friable, calcareous loam
29 to 60 inches—very pale brown, friable, calcareous loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.16 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy sediments weathered from calcareous siltstone
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Moderate

### Inclusions

*Contrasting inclusions:*
• Bridget soils, which have less clay in the subsoil than the Thirtynine soil and are on foot slopes above the Thirtynine soil
• Mitchell soils, which have less clay in the subsoil than the Thirtynine soil, do not have a dark surface layer, and are on foot slopes above the Thirtynine soil
• Epping soils, which are shallow over siltstone and are on knobs above the Thirtynine soil

*Similar inclusions:*
• Soils that are dark to a depth of more than 20 inches
• Areas where tillage has mixed the upper part of the subsoil with the remaining surface layer

### Use and Management

**Cultivated crops**

*Management measures:*
• Contour farming and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation.
• Adjusting the rate at which irrigation water is applied to the intake rate of the soil helps to control runoff and erosion.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded

to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings without basements**

*Management concerns:* A moderate limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Dwellings with basements**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIe-1; irrigated—IIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## TtC—Thirtynine loam, 3 to 6 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Slope range:* 3 to 6 percent (mainly 5 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Thirtynine soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Epping soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—dark grayish brown, very friable loam

*Subsoil:*
7 to 14 inches—brown, friable loam
14 to 23 inches—pale brown, friable loam
23 to 30 inches—very pale brown, calcareous, friable loam

*Substratum:*
30 to 60 inches—very pale brown, calcareous loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.16 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy sediments weathered from calcareous siltstone
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Bridget soils, which have less clay in the subsoil than the Thirtynine soil and are on foot slopes above the Thirtynine soil
• Epping soils, which are shallow over siltstone and are on knobs above the Thirtynine soil
• Mitchell soils, which do not have a dark surface layer, have less clay in the subsoil than the Thirtynine soil, and are on foot slopes above the Thirtynine soil

*Similar inclusions:*
• Some areas where the surface layer is very fine sandy loam
• Some areas where siltstone bedrock is at a depth of 40 to 60 inches
• Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation

because extensive land leveling would be required if surface irrigation methods were used.

**Rangeland and hay**

*Management measures:*
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings without basements**

*Management concerns:* A moderate limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Dwellings with basements:**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-1; irrigated—IIIe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## TtD—Thirtynine loam, 6 to 9 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Shoulders and back slopes
*Major uses:* Cropland and rangeland

### *Composition*

Thirtynine soil and similar soils: 85 percent (plus or minus 5 percent)

Contrasting inclusions:
Bridget soils—0 to 5 percent
Epping soils—0 to 5 percent
Mitchell soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 8 inches—dark grayish brown, friable loam

*Subsoil:*
8 to 13 inches—brown, friable silty clay loam
13 to 20 inches—pale brown, friable loam
20 to 26 inches—pale brown, friable, calcareous loam

*Substratum:*
26 to 60 inches—pale brown, calcareous loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 4 percent)
*Drainage class:* Well drained
*Available water capacity:* High (11.21 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy sediments weathered from calcareous siltstone
*Surface runoff:* Rapid
*Hazard of water erosion:* Severe
*Hazard of soil blowing:* Moderate

### *Inclusions*

*Contrasting inclusions:*
• Bridget soils, which have less clay in the subsoil than the Thirtynine soil and are on foot slopes above the Thirtynine soil
• Epping soils, which are shallow over siltstone and are higher on the landscape than the Thirtynine soil
• Mitchell soils, which have less clay in the subsoil than the Thirtynine soil and are on foot slopes above the Thirtynine soil

*Similar inclusions:*
• Some areas where the surface layer is very fine sandy loam
• Some areas where siltstone bedrock is at a depth of 40 to 60 inches
• Soils in which most of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.

• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.
• Wheel-track erosion can be controlled by applying irrigation water at a rate that results in maximum water absorption and minimum runoff.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

**Windbreaks**

*Management measures:*
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings without basements**

*Management concerns:* A moderate limitation because of the shrink-swell potential
*Management measures:*
• Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling.

**Dwellings with basements**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IVe-1; irrigated—IVe-4
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 4

## Tv—Tripp very fine sandy loam, 0 to 1 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 0 to 1 percent (mainly 0.5 percent)
*Major use:* Irrigated cropland

### *Composition*

Tripp soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—grayish brown, very friable very fine sandy loam

*Subsurface layer:*
6 to 14 inches—grayish brown, very friable very fine sandy loam

*Subsoil:*
14 to 24 inches—light brownish gray, very friable very fine sandy loam
24 to 32 inches—light gray, very friable very fine sandy loam
32 to 42 inches—white, very friable, calcareous very fine sandy loam

*Substratum:*
42 to 60 inches—very pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.78 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Alice soils, which have less silt and more sand than the Tripp soil and are in similar positions on the landscape

• Areas where the Tripp soil has been land leveled for gravity irrigation, the surface layer and all or part of the subsoil have been removed, and the calcareous substratum is exposed
• Some areas where gravelly soil material is exposed

*Similar inclusions:*
• Some areas where the surface soil is more than 20 inches thick
• Some areas where the surface soil is less than 7 inches thick and is lighter colored than is typical for the series
• Some areas where lime is below a depth of 40 inches

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIc-1; irrigated—IIe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## TvB—Tripp very fine sandy loam, 1 to 3 percent slopes

### *Setting*

*Landform:* Stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major use:* Irrigated cropland

### *Composition*

Tripp soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Alice soils—0 to 5 percent
Land-leveled Tripp soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—dark brown, very friable very fine sandy loam

*Subsurface layer:*
4 to 9 inches—brown, very friable very fine sandy loam

*Subsoil:*
9 to 24 inches—pale brown, very friable very fine sandy loam
24 to 35 inches—very pale brown, very friable, calcareous very fine sandy loam

*Substratum:*
35 to 60 inches—very pale brown, calcareous very fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderate (0.6 inch to 2.0 inches/hour)
*Parent material:* Loamy alluvium
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
• Alice soils, which have less silt and more sand than the Tripp soil and are in similar positions on the landscape

• Land-leveled Tripp soils in which the surface layer and all or part of the subsoil have been removed and calcareous material and some gravel are exposed

*Similar inclusions:*
• Some areas where the surface soil is more than 20 inches thick
• Some areas where the surface soil is thinner and lighter colored than is typical for the series
• Some areas where the soil has no subsoil or layer of accumulated lime

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Furrow, border, and sprinkler irrigation systems can be used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A moderate limitation because of the moderate permeability
*Management measures:*
• The restricted permeability generally can be overcome by increasing the size of the absorption field.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-6
*Windbreak suitability group:* 3
*Range site:* Silty
*Irrigation design group:* 6

## VaB—Valent fine sand, 0 to 3 percent slopes

### *Setting*

*Landform:* Dunes
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major use:* Rangeland

### *Composition*

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Jayem soils—0 to 5 percent
Sarben soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 5 inches—grayish brown, loose fine sand

*Substratum:*
5 to 60 inches—brown, loose fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.08 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Jayem soils, which have a dark surface layer, contain less sand than the Valent soil, and are slightly lower on the landscape
• Sarben soils, which contain less sand than the Valent soil and are in similar landscape positions

*Similar inclusions:*
• Soils with a surface layer of loamy fine sand
• Soils with a dark surface layer

### *Use and Management*

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.

• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-12
*Windbreak suitability group:* 7
*Range site:* Sandy
*Irrigation design group:* 12

## VaD—Valent fine sand, 3 to 9 percent slopes

### *Setting*

*Landform:* Dunes
*Slope range:* 3 to 9 percent (mainly 5 percent)
*Major use:* Rangeland (fig. 16)

### *Composition*

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Jayem soils—0 to 5 percent
Sarben soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 4 inches—brown, loose fine sand

*Substratum:*
4 to 60 inches—pale brown, loose fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.08 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Jayem soils, which contain less sand than the Valent soil and are on the lower, less sloping parts of the landscape
• Sarben soils, which contain less sand than the Valent soil and are on similar parts of the landscape

*Similar inclusions:*
• Soils with a surface layer of dark colored loamy fine sand

### *Use and Management*

**Cultivated crops**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used for range.

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

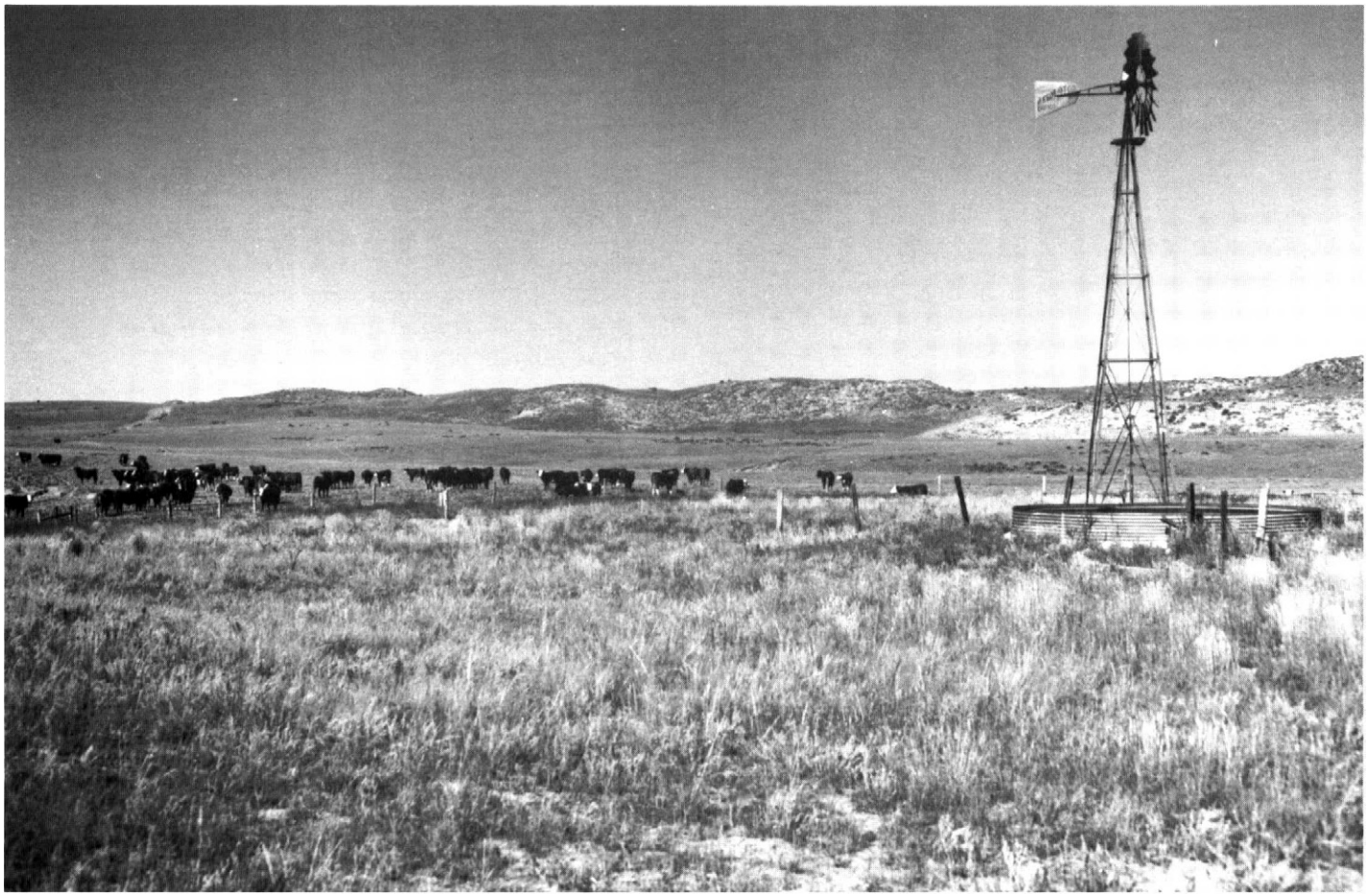

**Figure 16.—An area of Valent fine sand, 3 to 9 percent slopes, used as rangeland.**

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

*Management measures:*
- Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-12
*Windbreak suitability group:* 7
*Range site:* Sands
*Irrigation design group:* 12

## VaE—Valent fine sand, rolling

### *Setting*

*Landform:* Dunes
*Slope range:* 9 to 24 percent (mainly 15 percent)
*Major use:* Rangeland

### *Composition*

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Sarben soils—0 to 5 percent
Small blowouts—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—light brownish gray, loose fine sand

*Substratum:*
7 to 60 inches—pale brown fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.08 inches)
*Permeability:* Rapid (6 to 20 inches/hour)

*Parent material:* Sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
• Sarben soils, which contain less sand and more silt than the Valent soil and are lower on the landscape
• Small blowouts, which are barren areas of shifting sand and are subject to severe soil blowing

*Similar inclusions:*
• Soils that have a surface layer of loamy fine sand or loamy sand
• Soils that have a dark surface layer that is more than 10 inches thick
• Soils that have free carbonates within 15 inches of the surface

### Use and Management

**Cultivated crops**

*Suitability:* Not suited

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Management concerns:* A severe limitation because of the slope
*Management measures:*
• Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

**Septic tank absorption fields**

*Management concerns:* Severe limitations because of a poor filtering capacity and the slope
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly in areas where the slope is less than 15 percent.

### Interpretive Groups

*Land capability classification:* Dryland—VIe-5
*Windbreak suitability group:* 7
*Range site:* Sands

## VaF—Valent complex, rolling and hilly

### Setting

*Landform:* Dunes
*Slope range:* 9 to 60 percent (mainly 35 percent)
*Major use:* Rangeland (fig. 17)

### Composition

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Small blowouts—0 to 10 percent

### Typical Profile

*Surface layer:*
0 to 4 inches—pale brown, loose fine sand

*Substratum:*
4 to 60 inches—pale brown, loose fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.08 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy eolian material
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Very severe

### Inclusions

*Contrasting inclusions:*
• Small blowouts, which are almost barren of vegetation and are generally on side slopes or on the higher parts of the landscape

*Similar inclusions:*
• Soils with a surface layer of loamy fine sand

**Figure 17.—A good stand of native grasses in an area of Valent complex, rolling and hilly.**

## *Use and Management*

### Cultivated crops

*Suitability:* Not suited

### Rangeland and hay

*Management measures:*

- Shaping, seeding, and mulching hasten the reclamation of blowouts.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

### Windbreaks

*Management measures:*

- Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
- When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.
- Where the slope is more than 17 percent, hand planting and other special management practices are needed.
- Onsite investigation is needed to identify the best suited areas.

**Dwellings**

*Suitability:*
• A suitable alternative site is needed because of the slope.

**Septic tank absorption fields**

*Suitability:*
• A suitable alternative site is needed because of the slope and a poor filtering capacity

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5 in rolling areas, VIIe-5 in hilly areas
*Windbreak suitability group:* 7 in rolling areas, 10 in hilly areas
*Range site:* Sands in rolling areas, Choppy Sands in hilly areas

## VbB—Valent loamy fine sand, 0 to 3 percent slopes

### *Setting*

*Landform:* Dunes
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major use:* Rangeland

### *Composition*

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Sarben soils—0 to 4 percent
Jayem soils—0 to 3 percent
Vetal soils—0 to 3 percent

### *Typical Profile*

*Surface layer:*
0 to 6 inches—grayish brown, loose loamy fine sand

*Substratum:*
6 to 60 inches—light brownish gray, loose fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.26 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Sarben soils, which are loamy, have less sand than the Valent soil, and are in similar positions on the landscape
• Jayem soils, which have a dark surface layer, have less sand than the Valent soil, and are in similar positions on the landscape
• Vetal soils, which are lower on the landscape than the Valent soil and have a thicker and darker surface layer

*Similar inclusions:*
• Soils that have carbonates within a depth of 40 inches
• Soils with a surface layer of fine sand or very fine sand
• Soils with a dark surface layer

### *Use and Management*

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity

• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-11
*Windbreak suitability group:* 7
*Range site:* Sandy
*Irrigation design group:* 11

## VbD—Valent loamy fine sand, 3 to 9 percent slopes

### *Setting*

*Landform:* Dunes
*Slope range:* 3 to 9 percent (mainly 4 percent)
*Major use:* Rangeland

### *Composition*

Valent soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soils—0 to 2 percent
Jayem soils—0 to 4 percent
Sarben soils—0 to 3 percent
Rock outcrops—0 to 1 percent

### *Typical Profile*

*Surface layer:*
0 to 7 inches—brown, loose loamy fine sand

*Substratum:*
7 to 60 inches—brown, loose fine sand

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Excessively drained
*Available water capacity:* Low (4.26 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy eolian material
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe

### *Inclusions*

*Contrasting inclusions:*
• Busher soils, which are finer textured than the Valent soil, have a thicker surface layer, are 40 to 60 inches deep over bedrock, and are on the lower parts of the landscape
• Jayem and Sarben soils, which contain more silt and less sand than the Valent soil and are lower on the landscape
• Rock outcrops, which are on the highest parts of the landscape

*Similar inclusions:*
• Soils with a surface layer of fine sand or very fine sand
• Soils that have free carbonates within a depth of 40 inches
• Soils with a dark surface layer

### *Use and Management*

**Cultivated crops**

*Management measures:*
• A sprinkler system is the best method of irrigation because frequent, light applications of water are needed.
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.

**Rangeland and hay**

*Management measures:*
• Shaping, seeding, and mulching hasten the reclamation of blowouts.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after heavy rains, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Because seedlings can be damaged by high winds and covered by drifting sand, strips of sod or cover crops are needed between the tree rows to control soil blowing.
• When trees are planted in sod, they should be planted in shallow furrows with as little disturbance of the soil as possible.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Management concerns:* A severe limitation because of a poor filtering capacity
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
*Management measures:*
• Building up or mounding the site with suitable fill material increases the filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIe-5; irrigated—IVe-11
*Windbreak suitability group:* 7
*Range site:* Sands
*Irrigation design group:* 11

## VcB—Vetal fine sandy loam, 0 to 3 percent slopes

### *Setting*

*Landform:* Hillslopes
*Position on the landform:* Foot slopes and swales on summits
*Slope range:* 0 to 3 percent (mainly 1 percent)
*Major uses:* Cropland and rangeland

### *Composition*

Vetal soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent

### *Typical Profile*

*Surface layer:*
0 to 9 inches—brown, friable fine sandy loam

*Subsurface layer:*
9 to 24 inches—grayish brown, very friable fine sandy loam

*Transitional layer:*
24 to 36 inches—grayish brown, very friable fine sandy loam

*Substratum:*
36 to 60 inches—grayish brown, loose fine sandy loam

### *Soil Properties and Qualities*

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (9.6 inches)
*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### *Inclusions*

*Contrasting inclusions:*
- Bridget soils, which have less sand and more silt than the Vetal soil and are on similar landscapes

*Similar inclusions:*
- Soils having a surface layer that is thinner and is loamy very fine sand

### *Use and Management*

**Cultivated crops**

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow, border, and sprinkler irrigation systems can be used.
- Because of a high rate of water intake, the length of irrigation runs should be limited and water should be applied at frequent intervals.

**Rangeland and hay**

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.
- Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.

**Windbreaks**

*Management measures:*
- Strips of sod or cover crops between the tree rows help to control soil blowing.

**Dwellings**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### *Interpretive Groups*

*Land capability classification:* Dryland—IIIe-3; irrigated—IIe-8

*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## VgB—Vetal very fine sandy loam, 1 to 3 percent slopes

### Setting

*Landform:* Hillslopes and stream terraces
*Position on the landform:* Foot slopes, swales on summits, and stream terraces
*Slope range:* 1 to 3 percent (mainly 2 percent)
*Major uses:* Cropland and rangeland

### Composition

Vetal soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Bayard soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 7 inches—dark grayish brown, very friable very fine sandy loam

*Subsurface layer:*
7 to 30 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
30 to 45 inches—dark brown, very friable very fine sandy loam

*Substratum:*
45 to 60 inches—brown, very friable very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Surface runoff:* Slow
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
- Bridget soils, which contain more silt and less sand than the Vetal soil, have lime higher in the profile, and are in about the same landscape position
- Bayard soils, which have a thinner surface layer than that of the Vetal soil, have lime higher in the profile, and are in about the same landscape position

*Similar inclusions:*
- Soils that have a thinner, lighter colored surface layer
- Soils that have a surface layer and underlying material of loamy very fine sand

### Use and Management

#### Cultivated crops

*Management measures:*
- Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves soil moisture.
- Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
- Furrow, border, and sprinkler irrigation systems can be used.

#### Rangeland and hay

*Management measures:*
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
- Overgrazing should be avoided because it can deplete the protective plant cover, resulting in severe soil blowing.

#### Windbreaks

*Management measures:*
- Weeds and grasses can be controlled by cultivating or mowing between the tree rows with conventional equipment.
- Soil blowing can be controlled by maintaining strips of sod or annual cover crops between the tree rows.

#### Dwellings

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

#### Septic tank absorption fields

*Suitability:* Well suited
- Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IIe-3; irrigated—IIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## VgC—Vetal very fine sandy loam, 3 to 6 percent slopes

### Setting

*Landform:* Hillslopes
*Position on the landform:* Foot slopes
*Slope range:* 3 to 6 percent (mainly 4 percent)
*Major uses:* Cropland and rangeland

### Composition

Vetal soil and similar soils: 90 percent (plus or minus 5 percent)
Contrasting inclusions:
Bridget soils—0 to 5 percent
Oglala soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 12 inches—dark grayish brown, very friable very fine sandy loam

*Subsurface layer:*
12 to 30 inches—dark grayish brown, very friable very fine sandy loam

*Transitional layer:*
30 to 40 inches—grayish brown, very friable very fine sandy loam

*Substratum:*
40 to 60 inches—grayish brown, very friable very fine sandy loam

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Moderate (2 to 3 percent)
*Drainage class:* Well drained
*Available water capacity:* High (10.32 inches)
*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)
*Parent material:* Loamy and sandy alluvium and eolian sediments
*Surface runoff:* Medium
*Hazard of water erosion:* Moderate
*Hazard of soil blowing:* Severe

### Inclusions

*Contrasting inclusions:*
• Bridget soils, which contain more silt and less sand than the Vetal soil, have lime higher in the profile, and are in the slightly higher, convex areas
• Oglala soils, which have bedrock at a depth of 40 to 60 inches and are higher on the landscape than the Vetal soil

*Similar inclusions:*
• Some areas where the surface soil is loamy very fine sand or fine sandy loam
• Some areas where the soil has less than 20 inches of dark surface soil
• Some areas where a buried layer is below a depth of 30 inches

### Use and Management

**Cultivated crops**

*Management measures:*
• Including close-grown crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing.
• Terraces, contour farming, and grassed waterways help to control water erosion.
• A sprinkler system is the best method of irrigation because extensive land leveling would be required if surface irrigation methods were used.

**Rangeland and hay**

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Overgrazing should be avoided because it can cause poor plant vigor, can result in the formation of small gullies and rills after periods of heavy rainfall, and can deplete the protective plant cover, resulting in severe soil blowing.

**Windbreaks**

*Management measures:*
• Strips of sod or cover crops between the tree rows help to control soil blowing.
• A combination of contour planting and terraces helps to control water erosion.

**Dwellings**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

**Septic tank absorption fields**

*Suitability:* Well suited
• Limitations are slight and can be easily overcome.

### Interpretive Groups

*Land capability classification:* Dryland—IIIe-3; irrigated—IIIe-8
*Windbreak suitability group:* 5
*Range site:* Sandy
*Irrigation design group:* 8

## WhB—Wildhorse loamy fine sand, 0 to 3 percent slopes

### Setting

*Landform:* Stream terraces
*Slope range:* 0 to 3 percent (mainly 2 percent)
*Major use:* Rangeland

### Composition

Wildhorse soil and similar soils: 85 percent (plus or minus 5 percent)
Contrasting inclusions:
Bigwinder soils—0 to 5 percent
Lisco soils—0 to 5 percent
Las Animas soils—0 to 5 percent

### Typical Profile

*Surface layer:*
0 to 6 inches—dark grayish brown, very friable, calcareous loamy fine sand

*Transitional layer:*
6 to 12 inches—grayish brown, very friable, calcareous loamy fine sand

*Substratum:*
12 to 20 inches—grayish brown, calcareous loamy fine sand
20 to 29 inches—light brownish gray, calcareous loamy fine sand
29 to 47 inches—light gray, calcareous loamy fine sand
47 to 60 inches—very pale brown, calcareous loamy fine sand

### Soil Properties and Qualities

*Potential rooting depth:* Very deep (more than 60 inches)
*Content of organic matter:* Low (0.5 to 1.0 percent)
*Drainage class:* Somewhat poorly drained
*Depth to a seasonal high water table:* 18 to 42 inches
*Available water capacity:* Low (5.21 inches)
*Permeability:* Rapid (6 to 20 inches/hour)
*Parent material:* Sandy alluvium
*Surface runoff:* Slow
*Flooding:* Rare
*Hazard of water erosion:* Slight
*Hazard of soil blowing:* Very severe
*Distinctive property:* A high content of sodium

### Inclusions

*Contrasting inclusions:*
• Bigwinder soils, which are not high in content of sodium, are poorly drained, and are in the lower areas
• Lisco soils, which contain more silt and less sand than the Wildhorse soil and are in similar positions on the landscape
• Las Animas soils, which are not high in content of sodium, contain more silt and less sand than the Wildhorse soil, and are in similar landscape positions

*Similar inclusions:*
• Some areas where the soil has a surface layer of fine sand or fine sandy loam

### Use and Management

#### Rangeland and hay

*Management measures:*
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.
• Reed canarygrass and creeping foxtail can be grown on this somewhat poorly drained soil.
• Overgrazing and grazing when the soil is wet should be avoided because they can cause compaction and poor tilth and can deplete the protective plant cover, resulting in severe soil blowing. Also, grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years.
• Careful management is needed in very strongly alkaline areas, which support little or no vegetation and are subject to severe soil blowing during dry periods.

#### Windbreaks

*Suitability:* Generally not suited
• This soil has one or more characteristics that limit the planting, survival, or growth of trees and shrubs, but onsite investigation may identify small areas that are suitable for planting.

#### Dwellings

*Management concerns:* A moderate limitation on sites for dwellings without basements and a severe limitation on sites for dwellings with basements because of the wetness
*Management measures:*
• Dwellings should be constructed on well compacted fill material, which helps to prevent the damage caused by wetness and floodwater.

#### Septic tank absorption fields

*Suitability:*
• A suitable alternative site is needed because of the wetness and a poor filtering capacity.

### *Interpretive Groups*

*Land capability classification:* Dryland—VIs-1
*Windbreak suitability group:* 10
*Range site:* Saline Subirrigated

## Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 167,000 acres in the county, or nearly 13 percent of the total acreage, potentially is prime farmland. Because of the relatively dry climate in the county, only the land that is irrigated and meets the soil requirements is classified as prime farmland. About 47,000 acres in the county is used for irrigated crops. Scattered areas of prime farmland are throughout the county, but most are in the southwestern part, mainly in the Scoville-Alice-Tripp and Mitchell-Otero-Ashollow associations, which are described under the heading "General Soil Map Units." The main crops grown on this land are corn, sugar beets, alfalfa, and dry, edible beans.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that receive an inadequate amount of rainfall qualify as prime farmland only in areas where this limitation has been overcome by irrigation. The need for irrigation is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not the limitation has been overcome in a given area.

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