United States Department of Agriculture

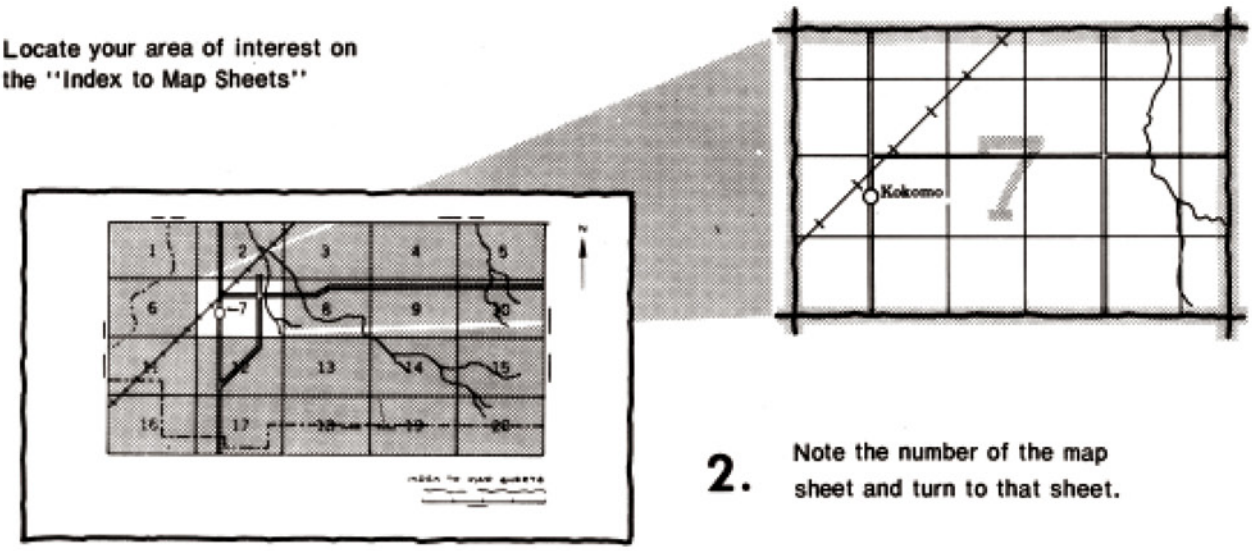
Soil Conservation Service

In cooperation with United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Indian Affairs; and South Dakota Agricultural Experiment Station

Soil Survey of Lyman County, South Dakota

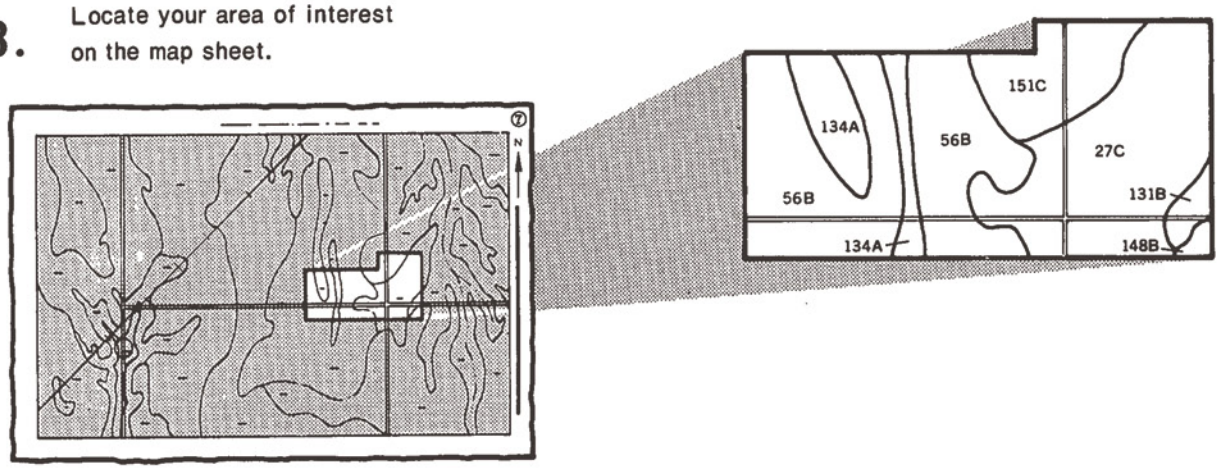
HOW TO USE

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

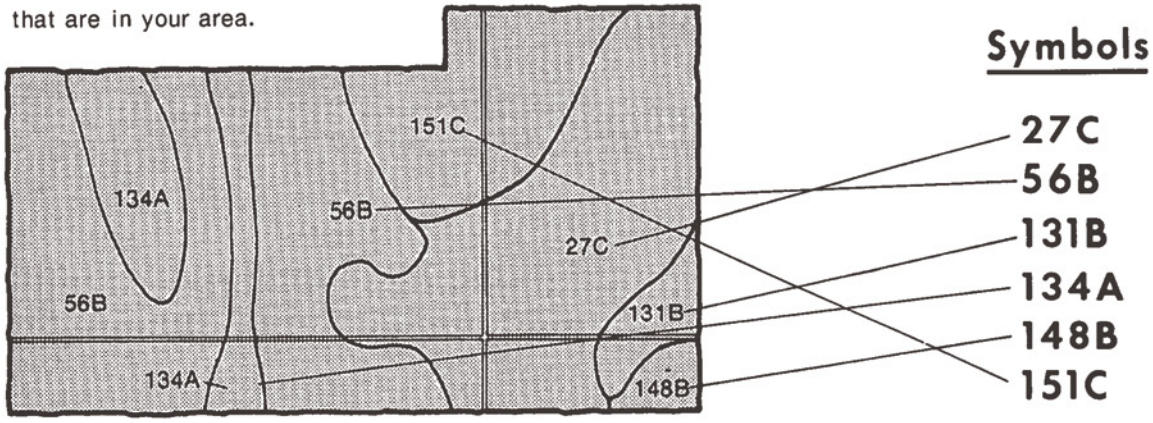


2. Note the number of the map sheet and turn to that sheet.

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

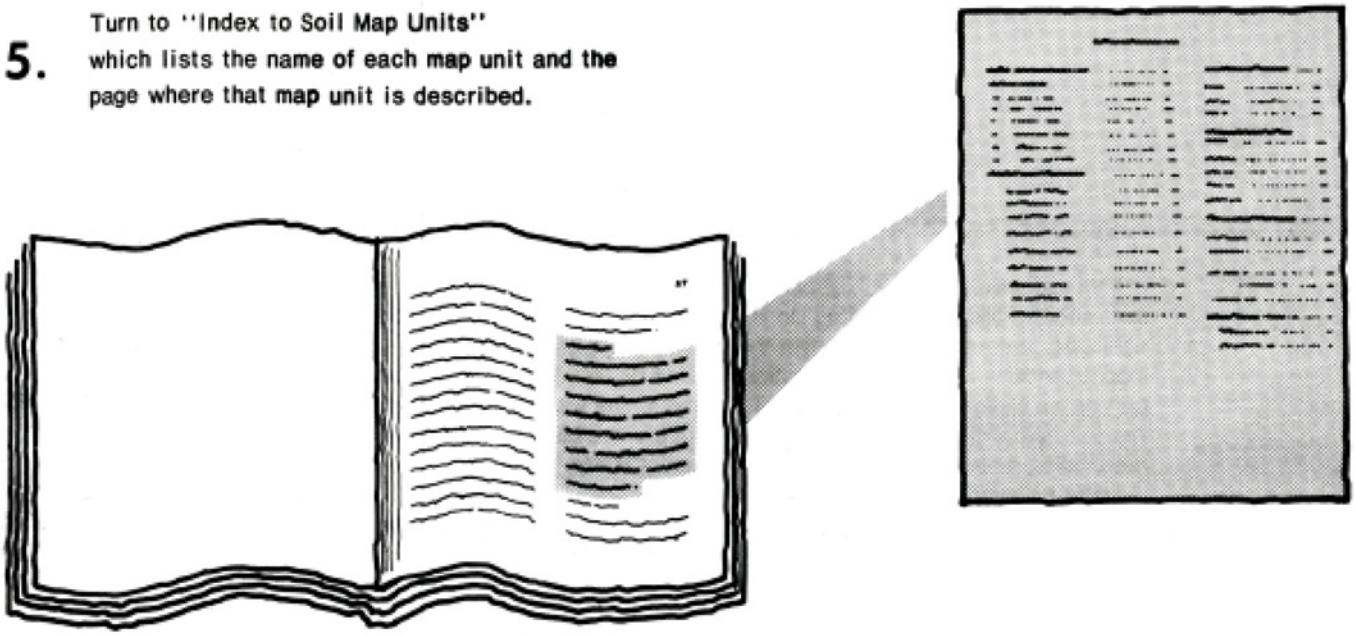


4. List the map unit symbols that are in your area.

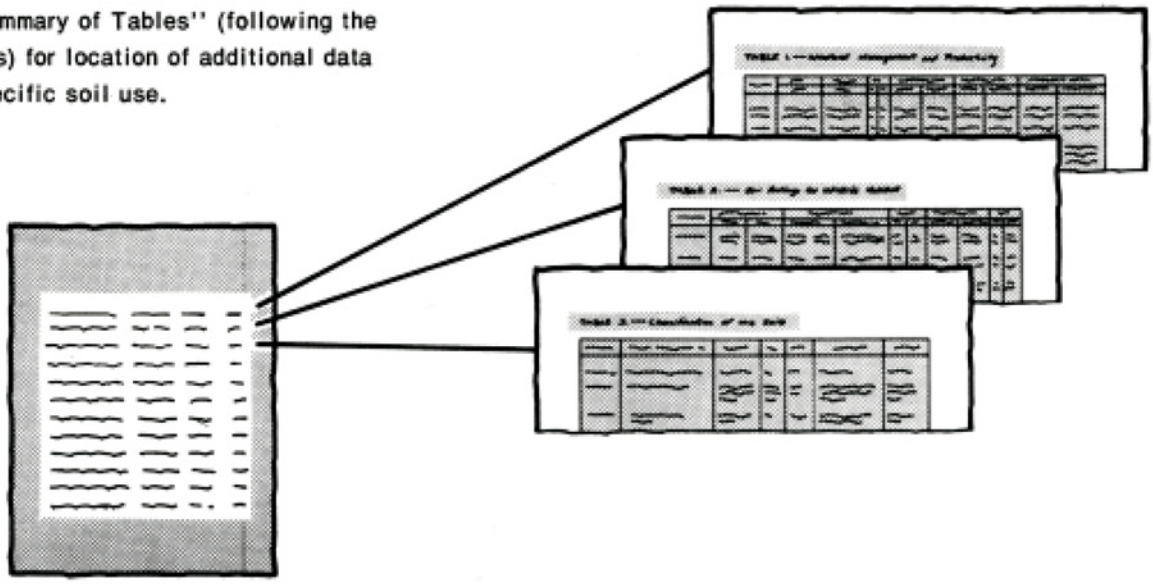


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and Forest Service; the United States Department of the Interior, Bureau of Indian Affairs; and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the American Creek Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue, the Bureau of Indian Affairs, and the Lyman County Commissioners.

Cover: Contour stripcropping in an area of Reliance silty clay loam, 0 to 3 percent slopes.

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Soil Series

Issued May 1987

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Lyman County, South Dakota. 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 Soil Conservation Service or the Cooperative Extension Service.

R.D. Swenson
State Conservationist
Soil Conservation Service

Soil Survey of
Lyman County, South Dakota

By Thomas M. Schumacher, Soil Conservation Service

Soils surveyed by Thomas M. Schumacher, Sharon K. Boschee, Roland K. Krauss, Julie M. Krueger, Thomas J. Martin, and C. Howard Wiesner, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with
United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station

LYMAN COUNTY is in the central part of South Dakota (fig. 1). It has a total area of 1,092,365 acres, or about 1,707 square miles, which includes about 47,025 acres of water. About 57,797 acres is administered by the Forest Service, 45,615 acres by the Corps of Engineers, and 106,444 acres by the Bureau of Indian Affairs. Lower Brule is the agency headquarters of the Lower Brule Indian Reservation.

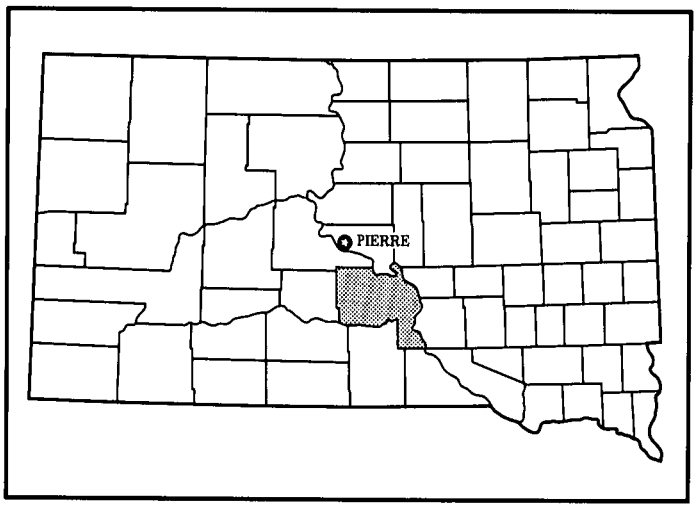

Figure 1.—Location of Lyman County in South Dakota.

According to the 1980 census, Lyman County has a population of 3,864. Presho, the largest town in the county, has a population of 760. Kennebec is the county seat. It has a population of 334. Other towns and villages in the county are Iona, Lower Brule, Lyman, Oacoma, Reliance, and Vivian.

General Nature of the County

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; ranching and farming; and natural resources.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Summers in Lyman County are usually quite warm. They are characterized by frequent hot spells and occasional cool days. The county is very cold in winter, when artic air frequently surges over the area. Most precipitation falls during the warm period, and rainfall is heaviest late in spring and early in summer. Winter snowfall is normally not too heavy. It is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Kennebec, South Dakota, in the period 1951 to 1980. 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 20 degrees F., and the average daily minimum temperature is 8 degrees. The lowest temperature on record, which occurred at Kennebec on February, 19, 1962, is -35 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Kennebec on August 13, 1965, is 114 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 inches. Of this, 13 inches, or nearly 80 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 11 inches. The heaviest 1-day rainfall during the period of record was 3 inches at Kennebec on August 30, 1971. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is about 31 inches. The greatest snow depth at any one time during the period of record was 30 inches. On the average, 26 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.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

Most of Lyman County is within Pierre Hills region in the Missouri Plateau section of the Great Plains physiographic province (*4*). The eastern edge, however, is in the Missouri River Trench. Lake Frances Case and Lake Sharpe are impoundments on the river.

The Pierre Hills generally are gently sloping to strongly sloping, but they are steep in areas along Lake Frances Case, Lake Sharpe, and the White River. The Missouri River, which flows south and southeast along the eastern border of the county, has cut a trench 2 to 4 miles wide and 300 to 450 feet deep. The White River, which flows east along most of the southern border of the county, has cut a trench 0.5 mile to 3.0 miles wide and 250 to 400 feet deep.

Elevation ranges from about 1,375 to 2,262 feet above sea level. The lowest elevation is along Lake Francis Case, in the southeastern part of the county. The highest is on Medicine Butte, north of Reliance.

Settlement

Lyman County was named after W.P. Lyman, an early settler. It was established by the Territorial Legislature in 1873 and organized in 1893. The original county included only about one-third of the present county. From 1897 to 1916, the county included all of the present Lyman and Jones Counties. After an election in 1916, the present boundaries were established (*5*). Oacoma, the county's oldest town, was the first county seat. In 1922, Kennebec was selected as the county seat.

The first homesteaders arrived in 1890. Ranching dominated until the extension of the railroad into the county in 1905. The population reached a high of 10,840 in 1910. It decreased quite rapidly to 6,591 by 1920. Since then, it has gradually decreased. It was to 3,864 in 1980. Presho, Kennebec, Oacoma, and Vivian are the major towns.

Railroads served the county from 1905 to 1982. Interstate 90, U.S. Highways 83 and 183, and South Dakota Highways 47, 49, and 273 are the main highways. Many rural areas do not have all-weather roads. As a result, these areas are almost impassable during rainy periods.

Ranching and Farming

Ranching is the principal enterprise in the county. The main type of livestock is beef cattle. About 53 percent of the farm income in the county is derived from the sale of livestock and livestock products (*6*). Most of the remainder of the farm income is derived from the sale of winter wheat and sorghum. Some of the crops are used as feed for livestock.

In 1982, the county had 422 ranches and farms, which averaged about 2,152 acres in size (*12*). The trend is toward fewer and larger ranches and farms. Many ranches in the northern part of the county lease additional grazing land from the Forest Service and through the Bureau of Indian Affairs.

About 63 percent of the acreage in the county is range, and about 36 percent is used for cultivated crops or for tame pasture and hay (*3*). Winter wheat is the main crop. It is grown under a summer fallow system of management. Grain sorghum is the second most common crop. Alfalfa, oats, and corn also are grown.

The American Creek Conservation District was organized in 1938. It has been instrumental in planting grasses and trees, which help to control erosion. The trees also help to protect farmsteads and provide cover for wildlife.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for crops and for the grasses grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

Lake Francis Case and Lake Sharpe are excellent sources of water for domestic and industrial uses and for irrigation. Many small dams, dugouts, and flows of the larger creeks provide water for livestock in most parts of the county. The principal source of water for domestic use and for livestock is shallow wells. Because many areas do not have a source of shallow water, deep wells, drilled to a depth of 900 to 1,500 feet, are an additional source of water. Water quantity generally is greater in the deep wells, but the quality is poor because of a high content of soluble salts.

Scattered deposits of sand and gravel are throughout the county. Because of an excessive content of fine rock fragments, such as shale, chalk, and clay ironstone, these deposits generally are unsuitable as construction material and concrete aggregate. They are suitable, however, as subgrade material for roads and as bituminous aggregate.

Coyote, cottontail, red fox, mule deer, white-tailed deer, and upland game birds, such as grouse and ring-necked pheasant, are the chief wildlife resources. The wetlands, mainly in the eastern part of the county, can be used for wetland wildlife production. In spring and fall, numerous species of ducks and geese migrate through the county. Bass, bluegill, perch, and other fish inhabit most of the smaller bodies of water. Lake Francis Case and Lake Sharpe provide excellent opportunities for fishing.

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 biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the 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 considerable 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, acidity, 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 interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a

fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot 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 several 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.

The 10 associations in Lyman County have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. Because of changes or refinements in some series concepts and differences in the design or extent of the associations, the names of the soils on the general soil map of this county do not coincide exactly with those on the general soil maps in the published surveys of Gregory, Stanley, and Tripp Counties.

Soil Descriptions

Nearly Level to Moderately Sloping, Clayey Soils on Uplands

These soils dominantly are nearly level to gently sloping but are moderately sloping in places. They make up about 40 percent of the county. About 70 percent of the acreage is cropland. The remainder is range. Winter wheat and grain sorghum are the main crops. Controlling erosion and conserving moisture are the main management concerns.

1. Millboro Association

Deep, well drained, nearly level to moderately sloping, clayey soils formed in clayey material

This association is on uplands characterized by low ridges and shallow drainageways. Slopes dominantly are nearly level and gently sloping but are moderately sloping in some areas. The drainage pattern is well defined in most areas but is poorly defined where drainageways terminate in small depressions.

This association makes up about 40 percent of the county. It is about 65 percent Millboro soils and 35 percent minor soils (fig. 2).

The Millboro soils have a slope of 0 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous silty clay. The subsoil and underlying material are grayish brown, calcareous clay and silty clay.

Minor in this association are the Boro, Hurley, Kolls, Lakoma, Opal, Promise, and Witten soils. Boro, Lakoma, and Opal soils are on the convex parts of the landscape. Boro soils have a thin surface layer. Lakoma and Opal soils are moderately deep over shale. The sodium affected Hurley soils are in nearly level areas. The poorly drained Kolls soils are in depressions. Promise soils contain more clay throughout than the Millboro soils. They are in positions on the landscape similar to those of the Millboro soils. The moderately well drained Witten soils are in swales.

About 70 percent of this association is cropland. Winter wheat and grain sorghum are the main crops. Some of the steeper areas along the drainageways support native grasses and are used for grazing. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing the major soils for crops. This association is suited to cultivated crops, tame pasture and hay, and range.

Nearly Level to Strongly Sloping, Silty Soils on Uplands

These soils dominantly are nearly level and gently sloping but are moderately sloping and strongly sloping in places. They make up about 13 percent of the county. About 75 percent of the acreage is cropland. Winter wheat, oats, corn, sorghum, and alfalfa are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns.

2. Millboro-McClure Association

Deep, well drained, nearly level to moderately sloping, silty soils formed in clayey material and in a thin mantle of loess over clayey material

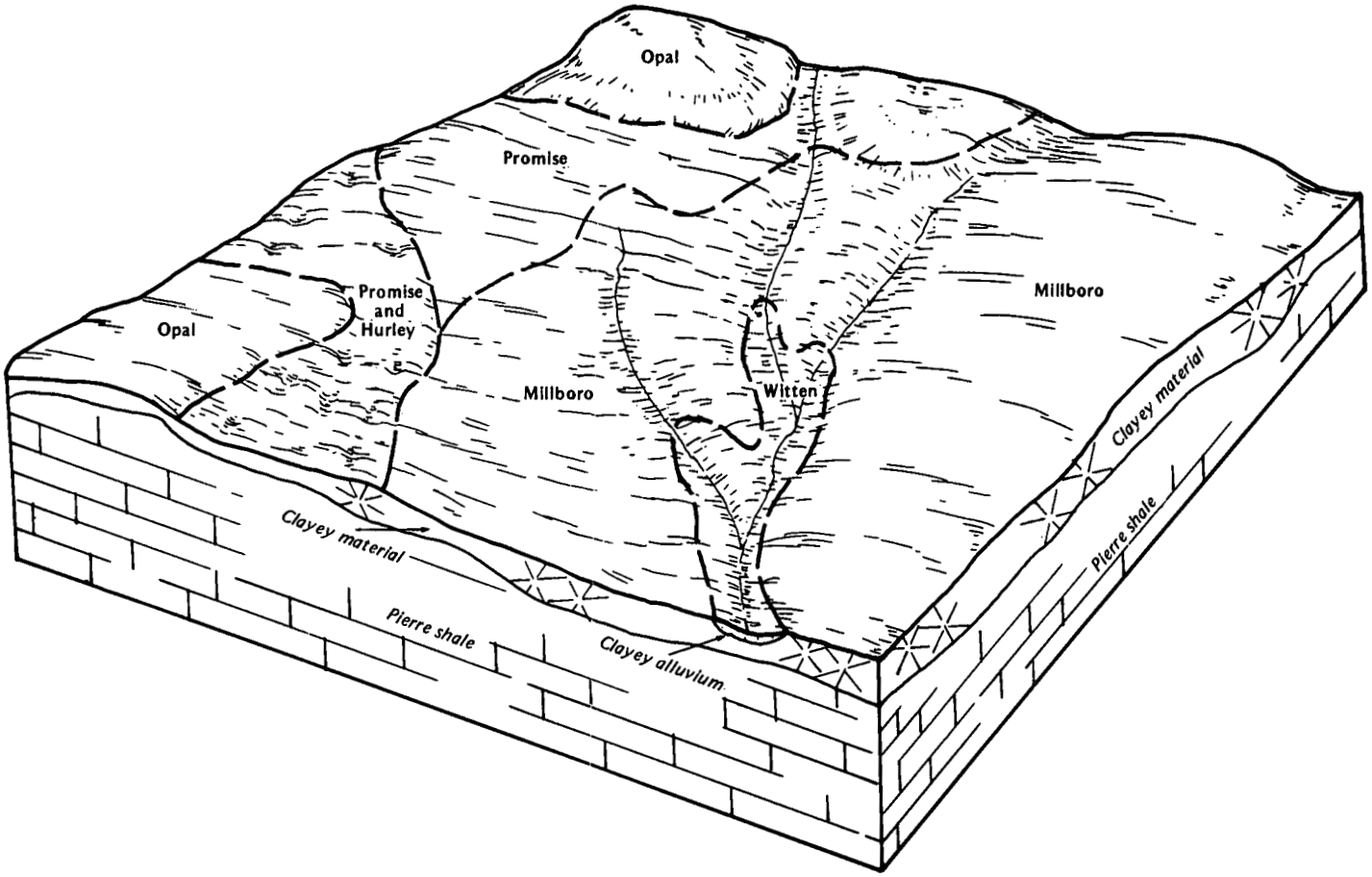

Figure 2.—Pattern of soils and parent material in the Millboro association.

This association is on uplands characterized by gentle rises interspersed with shallow swales and depressions. Slopes dominantly are nearly level and gently sloping but are moderately sloping in some areas. In many areas the drainageways terminate in small depressions. The drainage pattern is poorly defined in the nearly level areas, but it is well defined along the larger drainageways.

This association makes up about 9 percent of the county. It is about 65 percent Millboro soils, 15 percent McClure soils, and 20 percent minor soils.

The Millboro soils have a slope of 0 to 9 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is dark grayish brown and grayish brown silty clay. It is calcareous in the lower part. The underlying material is grayish brown, calcareous silty clay.

The McClure soils have a slope of 0 to 9 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown and brown silty clay loam in the upper part and grayish brown, calcareous silty clay and clay in the lower part. The underlying material is light brownish gray, calcareous silty clay.

Minor in this association are the Carter, Hoven, Hurley, Kolls, Onita, and Opal soils. Carter, Hurley, and Onita soils are on flats and in swales. Carter soils have a dense claypan subsoil. Hurley soils have a sodium affected subsoil. Onita soils are dark to a depth of more than 20 inches. The poorly drained Hoven and Kolls soils are in depressions. Opal soils are moderately deep over shale. They generally are on the side slopes along drainageways.

About 75 percent of this association is cropland. Winter wheat and grain sorghum are the main crops. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing the major soils for crops. This association is suited to cultivated crops, tame pasture and hay, and range.

3. Agar-McClure Association

Deep, well drained, nearly level to moderately sloping,

silty soils formed in loess and in a thin mantle of loess over clayey material

This association is on uplands characterized by gentle rises and shallow swales. Slopes dominantly are gently sloping but are nearly level in some areas and moderately sloping in others. In many areas the drainageways terminate in small depressions. The drainage pattern generally is well defined.

This association makes up about 2 percent of the county. It is about 48 percent Agar soils, 18 percent McClure soils, and 34 percent minor soils.

The Agar soils have a slope of 0 to 9 percent. Typically, the surface layer is dark gray silt loam. The subsoil is dark grayish brown, brown, and grayish brown silty clay loam. It is calcareous in the lower part. The underlying material is grayish brown, calcareous silty clay loam.

The McClure soils have a slope of 0 to 9 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown and brown silty clay loam in the upper part and grayish brown, calcareous silty clay and clay in the lower part. The underlying material is light brownish gray, calcareous silty clay.

Minor in this association are the Carter, Fairlo, Hoven, Millboro, Mobridge, Onita, and Opal soils. Carter, Mobridge, and Onita soils are on flats and in swales. Carter soils have a dense claypan subsoil. Mobridge and Onita soils are dark to a depth of more than 20 inches. Fairlo and Millboro soils are in landscape positions similar to those of the McClure soils. Fairlo soils are underlain by clayey material. Millboro soils are clayey throughout the subsoil. The poorly drained Hoven soils are in depressions. The moderately deep Opal soils are along drainageways.

About 85 percent of this association is cropland. Winter wheat, oats, corn, and sorghum are the main crops. Some areas are irrigated. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. This association is suited to cultivated crops, tame pasture and hay, and range.

4. Lowry Association

Deep, well drained, nearly level to strongly sloping, silty soils formed in loess

This association is on uplands characterized by long, smooth slopes. Slopes generally are nearly level and gently sloping but are moderately sloping and strongly sloping in places. The drainage pattern is well defined.

This association makes up about 2 percent of the county. It is about 65 percent Lowry soils and 35 percent minor soils.

The Lowry soils have a slope of 0 to 15 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray silt loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous silt loam.

Minor in this association are the Orton, Sansarc, Schamber, and Sully soils. The loamy Orton soils are in positions on the landscape similar to those of the Lowry soils. The shallow, clayey Sansarc soils are along steep drainageways. Schamber and Sully soils are on ridges and terrace scarps. Schamber soils are less than 5 inches deep over gravelly material. Sully soils have a thin surface layer.

About 60 percent of this association is cropland. Winter wheat, sorghum, alfalfa, corn, and oats are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. This association is suited to cultivated crops, tame pasture and hay, and range.

Nearly Level to Very Steep, Silty and Clayey Soils on Uplands

These soils dominantly are moderately sloping to steep but are gently sloping on the top of some buttes and very steep on the sides of the buttes. The soils make up about 45 percent of the county. About 95 percent of the acreage is range. Maintaining the most productive grasses is the main management concern.

5. Lakoma-Okaton Association

Moderately deep and shallow, well drained, gently sloping to steep, clayey soils formed in clayey shale residuum

This association is on uplands charcterized by ridges and narrow drainageways. Slopes dominantly are moderately sloping and strongly sloping but are gently sloping in some areas and moderately steep and steep in others. The drainage pattern is well defined.

This association makes up about 3 percent of the county. It is about 35 percent Lakoma soils, 30 percent Okaton soils, and 35 percent minor soils.

The moderately deep Lakoma soils are on side slopes. In this association they generally have a slope of 2 to 15 percent. Typically, they are calcareous silty clay throughout. The surface layer and subsoil are grayish brown, and the underlying material is light olive brown. Pale yellow shale is at a depth of about 25 inches.

The shallow Okaton soils are on ridges and on convex slopes along drainageways. In this association they generally have a slope of 6 to 40 percent. Typically, they are calcareous silty clay throughout. The surface layer is grayish brown. The next layer also is grayish brown. The underlying material is light brownish gray. Light brownish gray shale is at a depth of about 12 inches.

Minor in this association are the Boro, Millboro, Opal, and Promise soils. The deep Boro, Millboro, and Promise soils generally are lower on the landscape than the Lakoma and Okaton soils. Opal soils have a surface

layer that is darker than that of the Lakoma soils. They are in positions on the landscape similar to those of the Lakoma soils.

About 90 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses and controlling erosion and runoff are the main management concerns. In some areas the amount of woolly loco is sufficient to cause selenium poisioning in livestock. Winter wheat and grain sorghum are grown in some of the less sloping areas. The less sloping Lakoma soils are suited to cultivated crops and to tame pasture and hay. The Okaton soils generally are too steep for cultivated crops.

6. Lakoma-Okaton-Reliance Association

Deep to shallow, well drained, nearly level to very steep, clayey and silty soils formed in clayey shale residuum and in loess

This association consists primarily of the buttes in the southern part of the county. Ledges of hard sandstone are in the rimrock areas. Slopes generally are strongly sloping to very steep on the sides of the buttes but are nearly level to moderately sloping on the top of the buttes. The drainage pattern is well defined.

This association makes up less than 1 percent of the county. It is about 35 percent Lakoma soils, 30 percent Okaton soils, 25 percent Reliance soils, and 10 percent minor soils.

The moderately deep Lakoma soils are on the mid and lower side slopes. In this association they generally have a slope of 6 to 30 percent. Typically, they are calcareous silty clay throughout. The surface layer and subsoil are grayish brown. The underlying material is light olive brown. Pale yellow shale is at a depth of about 25 inches.

The shallow, rocky Okaton soils are on the steeper parts of the buttes and ridges. In this association they generally have a slope of 6 to 50 percent. Rock fragments cover 3 to 15 percent of the surface. Typically, the soils are calcareous silty clay throughout. The surface layer is grayish brown. The next layer also is grayish brown. The underlying material is light brownish gray. Light brownish gray shale is at a depth of about 12 inches.

The deep Reliance soils are on the top of the buttes. They have a slope of 0 to 9 percent. Typically, the surface soil is dark grayish brown silty clay loam. The subsoil is grayish brown, brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is pale brown, calcareous silty clay loam.

Minor in this association are the deep Boro, Millboro, Promise, and Ree soils. The clayey Boro, Millboro, and Promise soils are on the low parts of the landscape. Ree soils contain more sand and less clay in the subsoil than the Reliance soils. Also of minor extent are small areas of sandy and loamy soils below the areas of rimrock.

About 75 percent of this association is range. Maintaining the most productive grasses is the main management concern. In some areas the amount of woolly loco is sufficient to cause selenium poisioning in livestock. The Lakoma and Okaton soils are too steep and too stony for cultivated crops. The Reliance soils, however, are suited to cultivated crops. In most areas they are used as cropland. Alfalfa, oats, sorghum, and winter wheat are the main crops. Conserving moisture and controlling erosion are the main concerns in managing cultivated areas. The trees and shrubs along some drainageways provide excellent cover for wildlife and livestock.

7. Opal-Sansarc Association

Moderately deep and shallow, well drained, nearly level to steep, clayey soils formed in clayey shale residuum

This association is on uplands characterized by moderately steep slopes and entrenched drainageways. The soils generally are moderately sloping and strongly sloping but range from nearly level to steep. The drainage pattern is well defined.

This association makes up about 14 percent of the county. It is about 50 percent Opal soils, 15 percent Sansarc soils, and 35 percent minor soils.

The moderately deep Opal soils are on the less sloping, smooth parts of the landscape. In this association they generally have a slope of 0 to 15 percent. Typically, they are clay throughout. The surface layer is dark gray, the subsoil is grayish brown and calcareous, and the underlying material is grayish brown. Gray shale is at a depth of about 32 inches.

The shallow Sansarc soils are on ridges and on the steeper parts of the landscape. They have a slope of 6 to 40 percent. Typically, they are grayish brown, calcareous clay throughout. Light olive gray shale is at a depth of about 15 inches.

Minor in this association are the Boro, Bullcreek, Chantier, Millboro, and Promise soils. The deep Boro, Millboro, and Promise soils are on the low parts of the landscape. The saline Bullcreek and Chantier soils are on low side slopes and on foot slopes along drainageways.

About 95 percent of this association supports native grasses and is used for grazing and hay. Controlling erosion and runoff is the main management concern. Winter wheat and grain sorghum are grown in some of the less sloping areas. The less sloping Opal soils are suited to cultivated crops, tame pasture and hay, and range. The Sansarc soils are unsuited to cultivated crops and tame pasture and hay. They are suited to range.

8. Sansarc-Opal Association

Shallow and moderately deep, well drained, moderately sloping to steep, clayey soils formed in clayey shale residuum

This association is on uplands characterized by steep slopes and deeply entrenched drainageways. The soils generally are strongly sloping to steep but are less sloping on some side slopes. The drainage pattern is well defined.

This association makes up about 27 percent of the county. It is about 65 percent Sansarc soils, 25 percent Opal soils, and 10 percent minor soils (fig. 3).

The shallow Sansarc soils are on the steeper parts of the landscape. In this association they generally have a slope of 9 to 40 percent. Typically, they are grayish brown, calcareous clay throughout. Light olive gray shale is at a depth of about 15 inches.

The moderately deep Opal soils are on the less sloping parts of the landscape. In this association they generally have a slope of 6 to 25 percent. Typically, they are clay throughout. The surface layer is dark gray, the subsoil is grayish brown and calcareous, and the underlying material is grayish brown. Gray shale is at a depth of about 32 inches.

Minor in this association are the Bullcreek, Chantier, and Wendte soils and Rock outcrop. The deep, saline Bullcreek soils are on foot slopes. The moderately deep, saline Chantier soils are on low side slopes. The deep, moderately well drained Wendte soils are on narrow flood plains. The Rock outcrop is shale bedrock. It occurs in a random pattern throughout areas of the Sansarc soils.

Nearly all of this association supports native grasses and is used for grazing. Maintaining the most productive

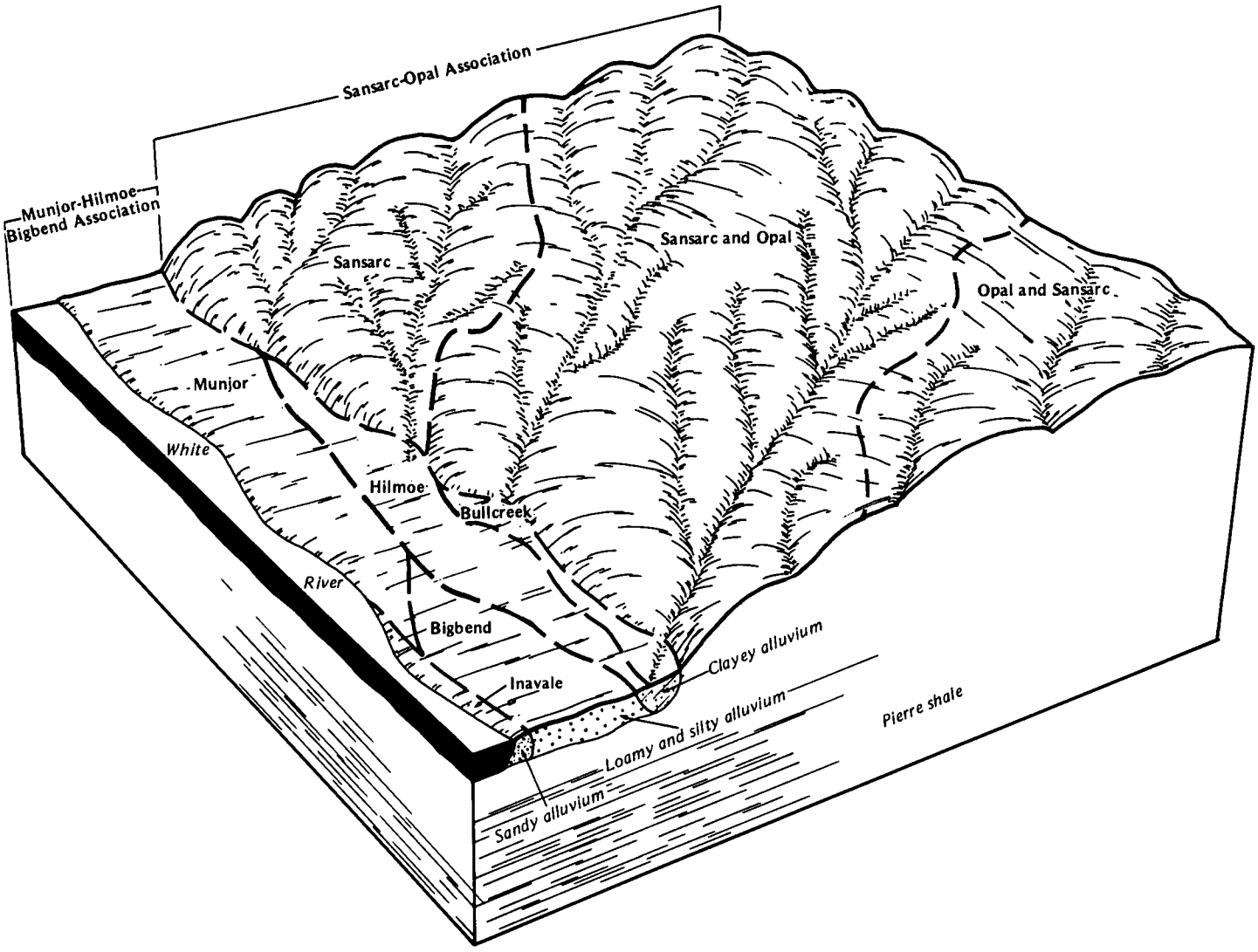

Figure 3.—Pattern of soils and parent material in the Sansarc-Opal and Munjor-Hilmoe-Bigbend associations.

grasses is the main management concern. This association is suited to range. It generally is too steep for cultivated crops and for tame pasture and hay.

Nearly Level and Gently Sloping, Loamy, Silty, and Clayey Soils on Flood Plains, Fans, Terraces, and Foot Slopes

These soils dominantly are nearly level but are gently sloping in places. They make up about 2 percent of the county. About 55 percent of the acreage supports native grasses and is used for grazing or hay. Winter wheat, oats, sorghum, and alfalfa are the main crops. Some areas are irrigated. Conserving moisture, controlling wind erosion, and improving tilth are the main management concerns.

9. Munjor-Hilmoe-Bigbend Association

Deep, well drained and moderately well drained, nearly level, loamy, silty, and clayey soils formed in alluvium

This association is on the flood plains along the White River. Narrow, low ridges and oxbows are in some areas. The soils are subject to flooding when ice jams dam the river and after intense rainfall. The flooding usually is of short duration.

This association makes up about 1 percent of the county. It is about 40 percent Munjor soils, 22 percent Hilmoe soils, 20 percent Bigbend soils, and 18 percent minor soils (fig. 3).

The loamy Munjor soils have a slope of 0 to 2 percent. Typically, the surface layer is light brownish gray, calcareous fine sandy loam. The underlying material is light gray, stratified, calcareous fine sandy loam, loamy sand, and sand.

The clayey Hilmoe soils have a slope of 0 to 2 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The underlying material is grayish brown, stratified, calcareous silty clay in the upper part and light brownish gray, stratified, calcareous silt loam and loam in the lower part.

The silty Bigbend soils have a slope of less than 2 percent. Typically, the surface layer is grayish brown, calcareous silt loam. The underlying material is pale brown, stratified, calcareous silt loam, very fine sandy loam, and fine sandy loam.

Minor in this association are the Bullcreek and Inavale soils. The saline Bullcreek soils are on foot slopes of the adjacent uplands. The somewhat excessively drained, sandy Inavale soils are adjacent to the river.

About 65 percent of this association is cropland. Alfalfa, sorghum, and small grain are the main crops. Corn also is grown on a small acreage. Some areas are irrigated. Conserving moisture, improving fertility, and controlling wind erosion are the main concerns in managing the major soils for cultivated crops. These soils are suited to cultivated crops, tame pasture and hay, and range. The trees and shrubs near the channel provide excellent cover for wildlife and livestock.

10. Wendte-Bullcreek Association

Deep, moderately well drained, nearly level and gently sloping, clayey soils formed in alluvium

This association is on flood plains, terraces, foot slopes, and fans along the larger drainageways. Slopes generally are nearly level but are gently sloping in some areas of the Bullcreek soils.

This association makes up about 1 percent of the county. It is about 65 percent Wendte soils, 30 percent Bullcreek soils, and 5 percent minor soils.

The Wendte soils are on narrow flood plains adjacent to entrenched drainageways. They have a slope of 0 to 2 percent. Typically, the surface layer is dark grayish brown, calcareous silty clay. The underlying material is grayish brown, stratified, calcareous silty clay, clay, silty clay loam, and clay loam.

The Bullcreek soils are on foot slopes, terraces, and fans adjacent to the flood plains. They have a slope of 0 to 6 percent. Typically, they are grayish brown, calcareous clay throughout. The lower part of the subsoil and the underlying material contain salts.

Minor in this association are the Chantier, Opal, and Sansarc soils on uplands. Chantier and Sansarc soils are shallow over shale. Opal soils are moderately deep over shale.

Nearly all of this association supports native grasses and is used for grazing. The major soils generally are too dense and too channeled for cultivated crops and tame pasture and hay. They are suited to range, but productivity is low in areas of the Bullcreek soils.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Agar silt loam, 0 to 3 percent slopes, is a phase in the Agar series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, 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. Promise-Hurley complex, 0 to 4 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. Pits, gravel, 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.

The names of some map units identified on the detailed soil maps of this county do not fully agree with those identified on the maps in the published surveys of Gregory, Stanley, and Tripp Counties. Differences are the result of variations in the design and composition of the map units or changes and refinements in series concepts.

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

Soil Descriptions

AaA—Agar silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 5 to 120 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsoil is dark grayish brown, brown, and grayish brown, friable silty clay loam about 36 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay loam. In places it is clay.

Included with this soil in mapping are small areas of Hoven, Millboro, and Mobridge soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Hoven soils are in depressions. Millboro soils contain more clay throughout than the Agar soil. They are in positions on the landscape similar to those of the Agar soil. The moderately well drained Mobridge soils are in swales.

Organic matter content is moderate and fertility medium in the Agar soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is

slow. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main cultivated crops. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface and minimizing tillage are examples.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIc-2; Silty range site; windbreak suitability group 3.

AaB—Agar silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 5 to 300 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsoil is dark grayish brown, brown, and grayish brown, friable silty clay loam about 36 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay loam. In places it is clay.

Included with this soil in mapping are small areas of Millboro and Mobridge soils. These soils make up as much as 10 percent of any one mapped area. Millboro soils contain more clay throughout than the Agar soil. They are in positions on the landscape similar to those of the Agar soil. The moderately well drained Mobridge soils are in swales.

Organic matter content is moderate and fertility medium in the Agar soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

AaC—Agar silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 5 to 80 acres in size. Slopes are slightly convex.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsoil is dark grayish brown, brown, and grayish brown, friable silty clay loam about 36 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay loam. In places it is clay. In some areas the soil is moderately eroded.

Included with this soil in mapping are small areas of Millboro and Opal soils. These soils make up less than 15 percent of any one mapped area. They contain more clay throughout than the Agar soil. They are on the lower side slopes.

Organic matter content is moderate and fertility medium in the Agar soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Oats, grain sorghum, and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Terraces, contour farming, and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Water erosion is a hazard, however, if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

Bg—Bigbend silt loam. This deep, well drained, nearly level soil is on the flood plains along the White River. It is subject to rare flooding. Areas are irregular in shape and 10 to more than 100 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown, calcareous silt loam about 3 inches thick. The underlying material to a depth of 60 inches is pale brown, stratified, calcareous silt loam, very fine sandy loam, and fine sandy loam.

Included with this soil in mapping are small areas of Hilmoe, Inavale, and Munjor soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained, clayey Hilmoe soils are farther from the river than the Bigbend soil. Munjor and Inavale soils contain more sand throughout than the Bigbend soil. Also, they are closer to the river.

Organic matter content and fertility are low in the Bigbend soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is cropland. Some areas are irrigated. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, and grain sorghum are the main cultivated crops. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity. Native trees and shrubs in some areas provide cover for wildlife and winter protection for livestock.

This soil is suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant supply of moisture grow especially well. They benefit from the moisture that the soil receives during the spring in most years.

The capability unit is IIc-1; Overflow range site; windbreak suitability group 1.

BuA—Bullcreek clay, 0 to 6 percent slopes. This deep, moderately well drained, nearly level and gently sloping soil is on foot slopes, terraces, and fans. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The soil is subject to rare flooding. Areas are long and narrow or irregular in shape and 10 to 1,000 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown, calcareous clay about 2 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 14 inches thick. In the lower part it has nests of gypsum and other salts that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. In some areas shale is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Opal, Promise, and Wendte soils and areas of Slickspots. These inclusions make up less than 15 percent of any one mapped area. The well drained Opal and Promise soils are higher on the landscape than the Bullcreek soil. The stratified Wendte soils are on narrow flood plains. Slickspots have a puddled surface. They support vegetation only during wet periods. They are in slight depressions.

Organic matter content is moderate and fertility low in the Bullcreek soil. The dense, compacted surface layer and subsoil restrict the penetration of plant roots. Tilth is very poor. Permeability is very slow. Available water capacity is low or moderate. Runoff is medium. The shrink-swell potential is very high.

All of the acreage supports native grasses and is used for grazing. Surface compaction is a problem during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The very poor tilth and the high content of salts are the major limitations.

The capability unit is VIs-5; Dense Clay range site; windbreak suitability group 10.

BxA—Bullcreek-Slickspots complex, 0 to 6 percent slopes. This map unit occurs as areas of a deep, moderately well drained, nearly level and gently sloping Bullcreek soil intermingled with areas of Slickspots. It is on foot slopes and along narrow drainageways in the uplands. When dry, the Bullcreek soil is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The landscape generally is dissected by small drainageways and gullies. The Bullcreek soil is on slight rises. It is subject to rare flooding. Slickspots are in small depressions. Areas are long and narrow or irregular in shape and 10 to 145 acres in size. They are 55 to 65 percent Bullcreek soil and 25 to 35 percent Slickspots. The Bullcreek soil and the Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Bullcreek soil is grayish brown, calcareous clay about 2 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 14 inches thick. In the lower part it has nests of gypsum and other salts that extend into the underlying material. The underlying material to a depth of 60 inches is

grayish brown, calcareous clay. In some areas shale is at a depth of 40 to 60 inches.

The surface of the Slickspots is so crusted that it is nearly impervious to water. Accumulations of salts are at or near the surface. The soil material to a depth of 60 inches is dense, massive clay.

Included with the Bullcreek soil and the Slickspots in mapping are small areas of Opal, Promise, and Wendte soils. These included soils make up less than 10 percent of any one mapped area. The well drained Opal and Promise soils are higher on the landscape than the Bullcreek soil. The stratified Wendte soils are on narrow flood plains.

Organic matter content is moderate and fertility low in the Bullcreek soil. The dense, compacted surface layer and subsoil restrict root penetration. Tilth is poor. Permeability is very slow. Available water capacity is low or moderate. Runoff is medium. The shrink-swell potential is very high.

All of the acreage is used as range (fig. 4). Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Slickspots generally support little or no vegetation, but they do support a sparse stand of weeds and pricklypear during wet periods.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The very poor tilth and the high content of salts are the major limitations.

Figure 4.—An area of Bullcreek-Slickspots complex, 0 to 6 percent slopes. All areas of this unit are used as range.

The Bullcreek soil is in capability unit VIs-5, Dense Clay range site, and windbreak suitability group 10; Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

CeA—Carter silt loam, 0 to 4 percent slopes. This deep, moderately well drained, nearly level and gently sloping soil is in swales and other areas on uplands. Areas are long and narrow or irregular in shape and 5 to 200 acres in size. Slopes are long and smooth and generally are slightly concave.

Typically, the surface layer is dark grayish brown and grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown and grayish brown, extremely firm clay about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay.

Included with this soil in mapping are small areas of Hoven, Hurley, Kolls, Millboro, and Promise soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Hoven and Kolls soils are in depressions. Hurley soils contain more sodium throughout than the Carter soil. They are in positions on the landscape similar to those of the Carter soil. The well drained Millboro and Promise soils do not have a dense claypan subsoil. They are slightly higher on the landscape than the Carter soil.

Organic matter content is moderate and fertility medium in the Carter soil. The dense claypan subsoil restricts the penetration of plant roots. Tilth is fair. Permeability is very slow. Available water capacity is low or moderate. Runoff is slow. The shrink-swell potential is very high in the subsoil.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem during wet periods. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay; however, it is somewhat droughty because of the dense claypan subsoil. It is better suited to early maturing small grain crops than to corn. Oats and winter wheat are the main cultivated crops. Examples of suitable pasture plants are alfalfa, crested wheatgrass, pubescent wheatgrass, and intermediate wheatgrass. Measures that improve tilth and conserve moisture are the main management needs in cultivated areas. Examples are including grasses and legumes in the cropping system, minimizing tillage, and subsoiling.

This soil is suited to windbreaks and environmental plantings, but the claypan subsoil is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IVs-2; Claypan range site; windbreak suitability group 9.

ChB—Chantier clay, 2 to 9 percent slopes. This shallow, well drained, gently sloping and moderately sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 50 acres in size. Slopes are long and smooth.

Typically, the surface layer is olive gray, calcareous clay about 2 inches thick. The subsoil is olive gray, very firm, calcareous clay about 13 inches thick. The underlying material is light olive gray, calcareous clay. The subsoil and underlying material have few to many accumulations of salts and gypsum. Gray shale is at a depth of about 19 inches.

Included with this soil in mapping are small areas of Bullcreek, Opal, and Sansarc soils and areas of Slickspots. These inclusions make up less than 10 percent of any one mapped area. The deep Bullcreek soils are on foot slopes. Opal and Sansarc soils are higher on the landscape than the Chantier soil. They do not have visible salts near the surface. Also, Opal soils are 20 and 40 inches deep over shale. Slickspots have a puddled surface. They support little or no vegetation.

Organic matter content and fertility are low in the Chantier soil. Tilth is very poor. The dense, compacted surface layer and subsoil restrict the penetration of plant roots. Permeability is very slow. Available water capacity is low. Runoff is medium or rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth. Water erosion is a problem unless an adequate plant cover is maintained. Establishing vegetation is difficult in denuded areas.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The very poor tilth, the high content of salts in the subsoil, and the low available water capacity are the major limitations.

The capability unit is VIs-5; Dense Clay range site; windbreak suitability group 10.

FaA—Fairlo silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and are 5 to 90 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 51 inches thick. It is dark brown and brown, friable silty clay loam in the upper part; pale brown, friable, calcareous silty clay loam in the next part; and light brownish gray, calcareous silty clay and silty clay loam in the lower part. Accumulations of carbonate are throughout the lower part of the subsoil. In places the depth to clayey material is more than 40 inches.

Included with this soil in mapping are small areas of Carter, Hurley, Kolls, and Mobridge soils. These soils make up less than 15 percent of any one mapped area. Carter, Hurley, and Mobridge soils are on the low parts of the landscape. Carter soils have a claypan subsoil. Hurley soils have a sodium affected subsoil near the surface. The moderately well drained Mobridge soils have dark colors that extend below a depth of 20 inches. The poorly drained Kolls soils are in depressions.

Organic matter content is moderate and fertility medium in the Fairlo soil. Tilth is good. Permeability is moderate in the upper part of the soil and slow in the lower part. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface and minimizing tillage are examples.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well.

The capability unit is IIc-2; Silty range site; windbreak suitability group 3.

FaB—Fairlo silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 5 to about 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 51 inches thick. It is dark brown and brown, friable silty clay loam in the upper part; pale brown, friable, calcareous silty clay loam in the next part; and light brownish gray, calcareous silty clay and silty clay loam in the lower part. Accumulations of carbonate are throughout the lower part of the subsoil. In places the depth to clayey material is more than 40 inches.

Included with this soil in mapping are small areas of Carter, Hurley, Kolls, and Mobridge soils. These soils make up less than 10 percent of any one mapped area. Carter, Hurley, and Mobridge soils are on the low parts of the landscape. Carter soils have a claypan subsoil. Hurley soils have a sodium affected subsoil near the surface. The moderately well drained Mobridge soils have dark colors that extend below a depth of 20 inches. The poorly drained Kolls soils are in depressions.

Organic matter content is moderate and fertility medium in the Fairlo soil. Tilth is good. Permeability is moderate in the upper part of the soil and slow in the lower part. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture and help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and terraces also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

Fp—Fluvaquents, ponded. These level, very poorly drained, alluvial soils are on the flood plains along the White River. They are ponded when the water level of Lake Francis Case is high. Areas are irregular in shape and 10 to more than 600 acres in size.

Typically, the surface layer is light colored, loamy material about 3 inches thick. The underlying material to a depth of 60 inches is light colored, stratified, loamy and silty material. In some areas the surface layer and underlying material are stratified loamy fine sand and sand.

A water table is within a depth of 3 feet when the water level in Lake Francis Case is low. As much as 4 feet of water ponds on the surface when the water level in the lake is high.

Included with these soils in mapping are small areas of the sandy Inavale, silty Bigbend, and loamy Munjor soils. These included soils do not have a water table within a depth of 3 feet and are not subject to ponding. They are higher on the flood plains than the Fluvaquents.

Nearly all areas support aquatic vegetation and are used as wetland wildlife habitat. The native vegetation dominantly is cattail, reedgrass, rushes, and willows. These soils are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the ponding.

The capability unit is VIIIw-1; no range site or windbreak suitability group is assigned.

Hm—Hilmoe silty clay. This deep, moderately well drained, nearly level soil is on the flood plains along the White River. It is subject to rare flooding. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown, calcareous silty clay about 11 inches thick. The upper part of the underlying material is grayish brown, firm, calcareous, stratified silty clay. The lower part to a depth of 60 inches is light brownish gray, calcareous loam that is stratified with thin layers of very fine sandy loam, loamy fine sand, silt loam, and clay loam. In places the soil is not underlain by loamy material.

Included with this soil in mapping are small areas of Bigbend and Munjor soils. These soils make up less than 10 percent of any one mapped area. The silty Bigbend and loamy Munjor soils are on very slight rises.

Organic matter content is moderate and fertility medium in the Hilmoe soil. Tilth is poor. Permeability is slow in the upper part of the soil and moderate in the lower part. Available water capacity is high. Runoff is slow. The shrink-swell potential is high in the upper part of the soil and moderate in the underlying material.

About half of the acreage supports native grasses and is used for grazing. Surface compaction is a problem during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth. Native trees and shrubs in some areas provide cover for wildlife and winter protection for livestock.

This soil is suited to cultivated crops and to tame pasture and hay (fig. 5). Grain sorghum and winter wheat are the main cultivated crops. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. The soil becomes compacted if farmed when wet and is difficult to till when dry. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Subsoiling also improves tilth.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

Figure 5.—An area of Hilmoe silty clay used for alfalfa.

The capability unit is IIIs-3; Clayey Overflow range site; windbreak suitability group 4C.

Ho—Hoven silt loam. This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are circular or oblong and are 5 to more than 100 acres in size.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is dark gray, very firm and firm silty clay about 28 inches thick. In the lower part it is calcareous and has accumulations of carbonate and nests of salts that extend into the underlying material. The underlying material to a depth of 60 inches is gray, calcareous silty clay.

Included with this soil in mapping are small areas of Kolls, Mobridge, and Onita soils. These soils make up less than 10 percent of any one mapped area. The poorly drained Kolls soils are in positions on the landscape similar to those of the Hoven soil. They do not have a sodium affected subsoil. The moderately well drained Mobridge and Onita soils are near the outer edge of the mapped areas.

Organic matter content is moderate and fertility low in the Hoven soil. Tilth is very poor. The sodium affected subsoil restricts the penetration of plant roots. Permeability is very slow. Available water capacity is low or moderate. A seasonal high water table is within a depth of 1.5 feet part of the year. As much as 1.0 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction and ponding are problems. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. It is suited to tame pasture and hay. The sodium affected subsoil and the ponding are problems. Western wheatgrass is an example of a suitable pasture plant. The less desirable species include Garrison creeping foxtail and reed canarygrass.

The capability unit is VIs-1; Closed Depression range site; windbreak suitability group 10.

HrA—Hurley silt loam, 0 to 6 percent slopes. This deep, moderately well drained, nearly level and gently sloping soil is on uplands. Areas are long and narrow or irregular in shape and are 5 to more than 600 acres in size. Slopes are long and are smooth or slightly concave.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is dark gray, olive gray, and grayish brown, very firm, calcareous clay about 31 inches thick. It has accumulations of carbonate and nests of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum and other salts throughout. In some areas shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Carter, Millboro, Opal, and Promise soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Carter soils have a surface layer that is thicker than that of the Hurley soil. Also, they have a lower content of salts in the subsoil. They are in positions on the landscape similar to those of the Hurley soil. The well drained Millboro, Opal, and Promise soils do not have a sodium affected subsoil. They are slightly higher on the landscape than the Hurley soil. Slickspots have a puddled surface. They support vegetation only during wet periods. They are in slight depressions.

Organic matter content and fertility are low in the Hurley soil. Tilth is very poor. The soil has a sodium affected subsoil and detrimental amounts of sodium salts. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The very poor tilth, the high content of salts in the subsoil, and the low available water capacity are limitations.

The capability unit is VIs-1; Thin Claypan range site; windbreak suitability group 10.

In—Inavale loamy fine sand. This deep, somewhat excessively drained, nearly level soil is on the flood plains along the White River. It is frequently flooded. Areas are irregular in shape and 5 to 40 acres in size.

Typically, the surface layer is grayish brown, calcareous loamy fine sand about 4 inches thick. The next 4 inches is light brownish gray, calcareous loamy fine sand. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sand stratified with thin layers of loamy fine sand.

Included with this soil in mapping are small areas of the well drained Bigbend and Munjor soils. These soils make up less than 10 percent of any one mapped area. They are farther from the river than the Inavale soil, generally on the higher parts of the flood plains.

Organic matter content and fertility are low in the Inavale soil. Tilth is poor. Permeability is rapid. Available water capacity is low. Runoff is slow.

Most areas support native grasses and are used for grazing and wildlife habitat. Wind erosion is a hazard. Sand blowouts can form in overgrazed areas. Maintaining an adequate plant cover helps to prevent excessive wind erosion. Range seeding is needed in some areas. Native trees and shrubs in some areas

provide excellent cover for wildlife and winter protection for livestock.

This soil generally is unsuited to cultivated crops and to tame pasture and hay. A severe hazard of wind erosion, the low fertility, and the low available water capacity are problems.

This soil is suited to environmental plantings, but only evergreen trees and shrubs can be successfully established. Planting directly in sod helps to control wind erosion.

The capability unit is VIe-8; Sands range site; windbreak suitability group 7.

Ko—Kolls silty clay. This deep, poorly drained, level soil is in depressions on uplands. When dry, it has cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The soil is ponded during periods of snowmelt and heavy rainfall. Areas are oval and are 5 to more than 1,000 acres in size.

Typically, the surface layer is dark gray, calcareous silty clay about 3 inches thick. The subsoil is dark gray and gray, extremely firm, calcareous clay about 26 inches thick. The underlying material to a depth of 60 inches is gray and grayish brown, calcareous clay. In places the soil is very poorly drained.

Included with this soil in mapping are small areas of Hoven and Witten soils. These soils make up less than 10 percent of any one mapped area. Hoven soils have a sodium affected subsoil. They are near the outer edges of the larger mapped areas. The moderately well drained Witten soils are slightly higher on the landscape than the Kolls soil.

Organic matter content is moderate and fertility medium in the Kolls soil. Tilth is very poor. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.5 feet part of the year. As much as 0.5 foot of water ponds on the surface during wet periods. Runoff is ponded. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction and ponding are problems. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. It is suited to tame pasture and hay. Ponding is the main hazard. Western wheatgrass is a suitable tame pasture plant. The less desirable species include Garrison creeping foxtail and reed canarygrass.

The capability unit is Vw-4; Closed Depression range site; windbreak suitability group 10.

Kp—Kolls silty clay, ponded. This deep, very poorly drained, level soil is in depressions on uplands. It is ponded during most of the growing season. Areas are oval or long and narrow. They are 5 to more than 200 acres in size.

Typically, the surface layer is dark gray, calcareous silty clay about 3 inches thick. The subsoil is dark gray and gray, extremely firm, calcareous clay about 26 inches thick. The underlying material to a depth of 60 inches is gray and grayish brown, calcareous clay.

Organic matter content is moderate, and fertility is medium. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.5 feet most of the year. As much as 1.5 feet of water ponds on the surface during wet periods. Runoff is ponded. The shrink-swell potential is very high.

Most areas are used as occasional habitat for deer, pheasant, and other wildlife. The vegetated areas commonly are interspersed with small bodies of water. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the ponding.

The capability unit is VIIw-1; Shallow Marsh range site; windbreak suitability group 10.

LaB—Lakoma silty clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to more than 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, friable, calcareous silty clay about 12 inches thick. The underlying material is light olive brown, calcareous silty clay in which the content of shale fragments is about 30 percent. Pale yellow shale is at a depth of about 25 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Witten soils in swales. These soils make up less than 5 percent of any one mapped area.

Organic matter content and fertility are low in the Lakoma soil. Tilth is fair. The surface layer has a high content of lime. Permeability is slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

About half of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. It can be controlled by restricted grazing during wet periods. In some areas, mainly in the northeastern part of the county, the amount of woolly loco is sufficient to cause selenium poisoning in livestock. Timely deferment of grazing and rotation grazing help to prevent serious poisoning problems.

This soil is suited to cultivated crops and to tame pasture and hay, but the droughtiness is a limitation. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Examples of

suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Winter wheat is the main crop. Measures that help to control erosion, improve tilth and fertility, and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion.

This soil is suited to windbreaks and environmental plantings. The high content of lime in the surface layer, however, adversely affects the availability of plant nutrients. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IIIe-4; Limy Clay range site; windbreak suitability group 4C.

LaC—Lakoma silty clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on ridges and on the side slopes of entrenched drainageways in the uplands. Areas are irregular in shape and 10 to 600 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, friable, calcareous silty clay about 12 inches thick. The underlying material is light olive brown, calcareous silty clay in which the content of shale fragments is about 30 percent. Pale yellow shale is at a depth of about 25 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Okaton, Opal, and Promise soils. These soils make up as much as 15 percent of any one mapped area. Okaton soils are less than 20 inches deep over shale. They generally are higher on the landscape than the Lakoma soil. Opal and Promise soils contain more clay throughout than the Lakoma soil. Also, they have a lower content of carbonates. They are on the low parts of the landscape.

Organic matter content and fertility are low in the Lakoma soil. Tilth is fair. The surface layer has a high content of lime. Permeability is slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns helps to prevent gullying. In some areas, mainly in the northwestern part of the county, the amount of woolly loco is sufficient to cause selenium poisoning in livestock. Timely deferment of grazing and rotation grazing help to prevent serious poisoning problems.

This soil is suited to cultivated crops and to tame pasture and hay, but the high content of lime in the surface layer adversely affects the availability of plant nutrients. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Winter wheat is the main crop. Measures that help to control erosion, conserve moisture, and improve tilth and fertility are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion. The soil generally is not suitable for terracing because the shale bedrock would be exposed in the terrace channel.

This soil is suited to windbreaks and environmental plantings. The high content of lime in the surface layer, however, adversely affects the availability of plant nutrients. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-4; Limy Clay range site; windbreak suitability group 4C.

LbD—Lakoma-Okaton silty clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Lakoma soil is on the smooth, mid and lower side slopes. The shallow Okaton soil is on ridges and the upper side slopes. Areas are irregular in shape and 10 to more than 1,600 acres in size. They are 50 to 60 percent Lakoma soil and 30 to 40 percent Okaton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Lakoma soil is grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, friable, calcareous silty clay about 12 inches thick. The underlying material is light olive brown, calcareous silty clay in which the content of shale fragments is about 30 percent. Pale yellow shale is at a depth of about 25 inches. In places the depth to shale is more than 40 inches.

Typically, the surface layer of the Okaton soil is grayish brown, calcareous silty clay about 3 inches thick. The next 4 inches also is grayish brown, calcareous silty clay. The underlying material is light brownish gray, calcareous silty clay. Light brownish gray shale is at a depth of about 12 inches.

Included with these soils in mapping are small areas of Opal and Promise soils. These included soils make up less than 15 percent of any one mapped area. They contain more clay throughout than the Lakoma soil. Also, they have a lower content of carbonates. They are on the low parts of the landscape.

Organic matter content and fertility are low in the Lakoma and Okaton soils. Permeability is slow. Available water capacity is low in the Lakoma soil and very low in

the Okaton soil. Runoff is rapid on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns helps to prevent gullying. Some areas are potential sites for stock water impoundments; however, seepage could be a problem. In some areas, mainly in the northwestern part of the county, the amount of woolly loco is sufficient to cause selenium poisoning in livestock. Timely deferment of grazing and rotation grazing help to prevent serious poisoning problems.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope and a severe erosion hazard.

The Lakoma soil is in capability unit VIe-4, Limy Clay range site; the Okaton soil is in capability unit VIe-12, Shallow range site; both soils are in windbreak suitability group 10.

LcE—Lakoma-Okaton complex, 9 to 50 percent slopes. These well drained, strongly sloping to very steep soils are on uplands. The moderately deep Lakoma soil is on the low parts of the landscape. The shallow Okaton soil is on the higher, steeper parts of ridges and buttes. Ledges of hard sandstone are in rimrock areas (fig. 6). Areas are irregular in shape and 10 to more than 1,000 acres in size. They are 40 to 50 percent Lakoma soil and 30 to 40 percent Okaton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Lakoma soil is grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, friable, calcareous silty clay about 12 inches thick. The underlying material is light

Figure 6.—An area of Lakoma-Okaton complex, 9 to 50 percent slopes. Rock crops out in most rimrock areas.

olive brown, calcareous silty clay. Pale yellow shale is at a depth of about 25 inches. In places the depth to shale is more than 40 inches.

Rock fragments cover 3 to 15 percent of the surface of the Okaton soil. Typically, the surface layer is grayish brown, calcareous silty clay about 3 inches thick. The next 4 inches also is grayish brown, calcareous silty clay. The underlying material is light brownish gray, calcareous silty clay. Light brownish gray shale is at a depth of about 12 inches.

Included with these soils in mapping are small areas of Opal, Promise, Ree, and Reliance soils. These included soils make up less than 20 percent of any one mapped area. Opal and Promise soils contain more clay throughout than the Lakoma soil. They are on the low parts of the landscape. Ree and Reliance soils do not have shale within a depth of 40 inches. They are on the high parts of the landscape. Also included is a small acreage of an excessively drained, sandy soil in scattered areas throughout the high parts of the landscape.

Organic matter content and fertility are low in the Lakoma and Okaton soils. Permeability is slow. Available water content is low in the Lakoma soil and very low in the Okaton soil. Runoff is rapid on both soils. The shrink-swell potential is high.

All areas support native grasses and are used for grazing. Water erosion is a hazard on these strongly sloping to very steep soils unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Gullies form along some cattle trails. In some areas, mainly in the northwestern part of the county, the amount of woolly loco is sufficient to cause selenium poisoning in livestock. Timely deferment of grazing and rotation grazing help to prevent serious poisoning problems.

These soils are too stony and too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Lakoma soil is in capability unit VIe-4, Limy Clay range site; the Okaton soil is in capability unit VIIs-6, Shallow range site; both soils are in windbreak suitability group 10.

LoA—Lowry silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 5 to more than 2,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very friable silt loam about 28 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In some areas clayey material is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Mobridge and Orton soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Mobridge soils are in swales. Orton soils are 20 to 40 inches deep over gravelly material. They are in positions on the landscape similar to those of the Lowry soil.

Organic matter content is moderate and fertility medium in the Lowry soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is cropland. Some areas are irrigated. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well.

The capability unit is IIc-2; Silty range site; windbreak suitability group 3.

LoB—Lowry silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 5 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very friable silt loam about 28 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In some areas clayey material is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Mobridge and Orton soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Mobridge soils are in swales. Orton soils are 20 to 40 inches deep over gravelly material. They are in positions on the landscape similar to those of the Lowry soil.

Organic matter content is moderate and fertility medium in the Lowry soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples

of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

LoC—Lowry silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 5 to 70 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very friable silt loam about 28 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In some areas the surface layer is 2 to 5 inches thick.

Included with this soil in mapping are small areas of Orton and Schamber soils. These soils make up less than 5 percent of any one mapped area. They are in positions on the landscape similar to those of the Lowry soil. Orton soils are 20 to 40 inches deep over gravelly material. The excessively drained Schamber soils are very shallow over gravelly sand.

Organic matter content is moderate and fertility medium in the Lowry soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Oats and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range; however, water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

LrD—Lowry-Sully silt loams, 9 to 25 percent slopes. These deep, well drained, strongly sloping and moderately steep soils are on uplands. The Lowry soil is on the smooth, less sloping parts of the landscape. The Sully soil is in the steeper, more convex areas. Areas are long and narrow and are 5 to more than 100 acres in size. They are 45 to 55 percent Lowry soil and 35 to 45 percent Sully soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Lowry soil is dark grayish brown silt loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very friable silt loam about 28 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam.

Typically, the surface layer of the Sully soil is grayish brown silt loam about 4 inches thick. The next 15 inches is light brownish gray, calcareous silt loam. The underlying material to a depth of 60 inches also is light brownish gray, calcareous silt loam.

Included with these soils in mapping are small areas of Sansarc and Schamber soils. These included soils make up less than 10 percent of any one mapped area. Sansarc soils are 8 to 20 inches deep over shale. They are on the steeper slopes, generally below the Sully soil. The excessively drained Schamber soils are very shallow over gravelly sand. They are in positions on the landscape similar to those of the Sully soil.

Organic matter content is moderate and fertility medium in the Lowry soil. Organic matter content and fertility are low in the Sully soil. Permeability is moderate in both soils. Available water capacity is high. Runoff is rapid.

Most of the acreage supports native grasses and is used for grazing or hay. Water erosion is a hazard on these strongly sloping and moderately steep soils unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This map unit is suited to cultivated crops. Crop growth is restricted on the Sully soil, however, because of a high content of lime in the surface layer, the low content of organic matter, and the slope. Both soils are suited to tame pasture and hay, but the high content of lime in the surface layer of the Sully soil is a limitation. Examples of suitable pasture plants are intermediate

wheatgrass and smooth bromegrass. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, farming on the contour, establishing grassed waterways, and terracing.

The Lowry soil is suited to windbreaks and environmental plantings, but the Sully soil generally is unsuited because it is too steep. All climatically suited trees and shrubs grow well on the Lowry soil, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The Lowry soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 3; the Sully soil is in capability unit VIe-3, Thin Upland range site, and windbreak suitability group 10.

McA—McClure silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is dark grayish brown and brown, firm silty clay loam in the upper part and grayish brown, very firm, calcareous silty clay and clay in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Carter, Hurley, Kolls, Millboro, and Onita soils. These soils make up less than 10 percent of any one mapped area. Carter and Hurley soils are in the low parts of the landscape. They have a claypan subsoil. The poorly drained Kolls soils are in depressions. Millboro soils contain more clay in the upper part of the subsoil than the McClure soil. They are in positions on the landscape similar to those of the McClure soil. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the McClure soil. Tilth is fair. Permeability is moderately slow in the subsoil and slow in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that conserve moisture and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well.

The capability unit is IIc-2; Silty range site; windbreak suitability group 3.

McB—McClure silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to more than 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is dark grayish brown and brown, firm silty clay loam in the upper part and grayish brown, very firm, calcareous silty clay and clay in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Carter, Hurley, Millboro, Onita, and Opal soils. These soils make up less than 15 percent of any one mapped area. Carter and Hurley soils have a claypan subsoil. They are in nearly level areas. Millboro and Opal soils contain more clay in the upper part of the subsoil than the McClure soil. Also, they are slightly lower on the landscape. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the McClure soil. Tilth is fair. Permeability is moderately slow in the subsoil and slow in the underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable pasture plants. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, improve tilth, and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

McC—McClure silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 5 to 50 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is dark grayish brown and brown, firm silty clay loam in the upper part and grayish brown, very firm, calcareous silty clay and clay in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay.

Included with this soil in mapping are small areas of Millboro and Opal soils. These soils make up less than 10 percent of any one mapped area. They contain more clay in the subsoil than the McClure soil. They are on low side slopes.

Organic matter content is moderate and fertility medium in the McClure soil. Tilth is fair. Permeability is moderately slow in the subsoil and slow in the underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range; however, water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

MIA—Millboro silty clay loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 5 to more than 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is dark grayish brown and grayish brown, very firm silty clay about 47 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Carter, Hoven, Kolls, McClure, and Onita soils. These soils make up less than 15 percent of any one mapped area. Carter soils have a claypan subsoil. They are on flats. The poorly drained Hoven and Kolls soils are in depressions. McClure soils have less clay in the subsoil than the Millboro soil. They are on the high parts of the landscape. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the Millboro soil. Tilth is fair. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that conserve moisture and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Subsoiling also improves tilth.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

MIB—Millboro silty clay loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 2,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is dark grayish brown and grayish brown, very firm silty clay about 47 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Carter, Hoven, Kolls, McClure, and Onita soils. These soils make up less than 10 percent of any one mapped area. Carter soils have a claypan subsoil. They are on flats. The poorly drained Hoven and Kolls soils are in depressions. McClure soils have less clay in the subsoil

than the Millboro soil. They are on the high parts of the landscape. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the Millboro soil. Tilth is fair. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways also help to control erosion.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

MIC—Millboro silty clay loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 5 to 50 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is dark grayish brown and grayish brown, very firm silty clay about 47 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay.

Included with this soil in mapping are small areas of McClure and Opal soils. These soils make up less than 10 percent of any one mapped area. McClure soils have less clay in the subsoil than the Millboro soil. They are on the high parts of the landscape. Opal soils are 20 and 40 inches deep over shale. They are on some of the upper side slopes.

Organic matter content is moderate and fertility medium in the Millboro soil. Tilth is fair. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails.

This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways help to control erosion. Chiseling and subsoiling increase the rate of water intake and improve tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

MmA—Millboro silty clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 1,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous silty clay about 5 inches thick. The subsoil is about 48 inches of grayish brown, very firm and firm, calcareous clay and silty clay. In the lower part it has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil contains more clay throughout.

Included with this soil in mapping are small areas of Hurley, Kolls, and Witten soils. These soils make up less than 10 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are are on flats. The poorly drained Kolls soils are in depressions. The moderately well drained Witten soils are in swales.

Organic matter content is moderate and fertility medium in the Millboro soil. Tilth is poor. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that conserve moisture, help to control wind erosion, and improve tilth are the main management needs in cultivated areas.

Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling and subsoiling increase the rate of water intake and improve tilth.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

MmB—Millboro silty clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 2,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous silty clay about 5 inches thick. The subsoil is about 48 inches of grayish brown, very firm and firm, calcareous clay and silty clay. In the lower part it has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil contains more clay throughout. In places the surface layer is not so dark.

Included with this soil in mapping are small areas of Hurley, Kolls, and Witten soils. These soils make up less than 10 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are on the low parts of the landscape. The poorly drained Kolls soils are in depressions. The moderately well drained Witten soils are in swales.

Organic matter content is moderate and fertility medium in the Millboro soil. Tilth is poor. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, stripcropping, and grassed waterways help to control erosion. Chiseling and subsoiling increase the rate of water intake and improve tilth.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

MnB—Millboro-Boro silty clays, 2 to 6 percent slopes. These deep, well drained, gently sloping soils are on uplands. When dry, they are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The Millboro soil is on smooth and concave slopes. The Boro soil is on the upper, convex parts of the landscape. Areas are irregular in shape and 10 to more than 300 acres in size. They are 45 to 60 percent Millboro soil and 35 to 45 percent Boro soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Millboro soil is dark grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 48 inches thick. In the lower part it has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil contains more clay throughout.

Typically, the surface layer of the Boro soil is dark grayish brown, calcareous silty clay about 4 inches thick. The subsoil is grayish brown, calcareous silty clay about 32 inches thick. It has accumulations of carbonate throughout. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil is 20 to 40 inches deep over shale.

Included with these soils in mapping are small areas of Kolls and Witten soils. These included soils make up less than 10 percent of any one mapped area. The poorly drained Kolls soils are in depressions. The moderately well drained Witten soils are in swales.

Organic matter content is moderate and fertility medium in the Millboro soil. Organic matter content and fertility are low in the Boro soil. Tilth is poor in both soils. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay, but they become compacted if farmed when wet and are difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve

fertility and tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways help to control erosion. Chiseling and subsoiling increase the rate of water intake and improve tilth.

If these soils are used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

These soils are suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

MnC—Millboro-Boro silty clays, 6 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands. When dry, they are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The Millboro soil is on the mid and lower parts of the landscape. The Boro soil is on narrow ridges and the upper side slopes. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 50 percent Millboro soil and 35 to 45 percent Boro soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Millboro soil is dark grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 48 inches thick. In the lower part it has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil contains more clay throughout.

Typically, the surface layer of the Boro soil is dark grayish brown, calcareous silty clay about 4 inches thick. The subsoil is grayish brown, calcareous silty clay about 32 inches thick. It has accumulations of carbonate throughout. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In some areas the soil is 20 to 40 inches deep over shale.

Included with these soils in mapping are small areas of Okaton and Opal soils. These included soils make up less than 15 percent of any one mapped area. Okaton soils are 8 to 20 inches deep over shale. They are on shoulder slopes. Opal soils are 20 to 40 inches deep over shale. They occur as scattered areas intermingled with areas of the Millboro soil.

Organic matter content is moderate and fertility medium in the Millboro soil. Organic matter content and fertility are low in the Boro soil. Tilth is poor in both soils. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

About half of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay; however, they become compacted if farmed when wet and are difficult to till when wet. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main cultivated crops. Measures that help to control erosion, conserve moisture, and improve fertility and tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Terraces, contour farming, and grassed waterways also help to control erosion. In some areas, however, the slopes are too short or too irregular for terracing.

These soils are suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

Mp—Mobridge silt loam. This deep, moderately well drained, nearly level soil is in swales on uplands. It is occasionally flooded for very brief periods. Areas are long and narrow or irregularly shaped. They are 5 to 30 acres in size. Slopes are slightly concave.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is dark grayish brown and light brownish gray, friable silty clay loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Agar, Carter, Hoven, and McClure soils. These soils make up less than 10 percent of any one mapped area. The well drained Agar and McClure soils are on the high parts of the landscape. Carter soils have a claypan subsoil. They are in positions on the landscape similar to those of the Mobridge soil. The poorly drained Hoven soils are in depressions.

Organic matter content and fertility are high in the Mobridge soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, green needlegrass,

intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture during dry periods are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage. In some years fieldwork is delayed because the soil receives runoff from the adjacent soils, but in most years the additional moisture is beneficial.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

The capability unit is IIc-3; Overflow range site; windbreak suitability group 1.

Mr—Munjor fine sandy loam. This deep, well drained, nearly level soil is on the flood plains along the White River. It is subject to rare flooding. Areas are irregular in shape and 10 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is light brownish gray, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous, stratified fine sandy loam, loamy sand, fine sand, and sand.

Included with this soil in mapping are small areas of Bigbend, Hilmoe, and Inavale soils. These soils make up less than 15 percent of any one mapped area. Bigbend soils contain more silt throughout than the Munjor soil. They occur in a random pattern throughout the map unit. The clayey Hilmoe soils are farther from the river than the Munjor soil. The somewhat excessively drained Inavale soils are on slight rises adjacent to the river.

Organic matter content and fertility are low in the Munjor soil. Tilth is good. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most of the acreage is cropland. Some areas are irrigated. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Oats and grain sorghum are the main crops. Measures that conserve moisture, improve fertility, and help to control wind erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and stripcropping. Including grasses and legumes in the cropping system also improves fertility.

If this soil is used for range, wind erosion is a hazard in overgrazed areas. Scattered trees and shrubs provide winter protection for livestock and wildlife.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

The capability unit is IIIe-7; Sandy range site; windbreak suitability group 1.

Mv—Munjor-Inavale complex. These deep, nearly level soils are on the flood plains along the White River. The well drained Munjor soil is on the smooth, slightly concave parts of the landscape. It is occasionally flooded for very brief periods. The excessively drained Inavale soil is adjacent to the river. It is frequently flooded for very brief periods. Areas are long and narrow and are 10 to more than 50 acres in size. They are 60 to 70 percent Munjor soil and 20 to 30 percent Inavale soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Munjor soil is light brownish gray, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light gray, stratified, calcareous fine sandy loam, loamy sand, and sand.

Typically, the surface layer of the Inavale soil is grayish brown, calcareous loamy fine sand about 4 inches thick. The next 4 inches is light brownish gray, calcareous loamy fine sand. The underlying material to a depth of 60 inches is light brownish gray, stratified, calcareous loamy fine sand and fine sand.

Included with these soils in mapping are small areas of Bigbend and Hilmoe soils. These included soils make up less than 10 percent of any one mapped area. The silty Bigbend soils are slightly lower on the landscape than the Munjor and Inavale soils. The clayey Hilmoe soils are farther from the river than the Munjor and Inavale soils.

Organic matter content and fertility are low in the Munjor and Inavale soils. Tilth is good in the Munjor soil and poor in the Inavale soil. Permeability is moderately rapid in the Munjor soil and rapid in the Inavale soil. Available water capacity is moderate in the Munjor soil and low in the Inavale soil. Runoff is slow on both soils.

About half of the acreage supports native grasses and is used for grazing. Wind erosion is a hazard. Sand blowouts can form in overgrazed areas of the Inavale soil. Maintaining an adequate plant cover helps to control wind erosion. Range seeding is needed in some areas. Native trees and shrubs in some areas provide excellent cover for wildlife and winter protection for livestock.

This map unit is suited to cultivated crops and tame pasture and hay, but crop growth is restricted on the sandy, droughty Inavale soil. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Although these soils are subject to flooding, they are very seldom flooded during the growing season of most crops. Measures that help to control wind erosion,

conserve moisture, improve fertility, and increase the organic matter content are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

These soils are suited to windbreaks and environmental plantings, but only evergreen trees grow well on the Inavale soil. All climatically suited trees and shrubs grow well on the Munjor soil. Those that require an abundant supply of moisture grow especially well.

The Munjor soil is in capability unit IIIe-7, Overflow range site, and windbreak suitability group 1; the Inavale soil is in capability unit VIe-8, Sands range site, and windbreak suitability group 7.

OhE—Okaton-Lakoma silty clays, 15 to 40 percent slopes. These well drained, moderately steep and steep soils are on uplands. The shallow Okaton soil is on the convex parts of the landscape. The moderately deep Lakoma soil is on side slopes. Scattered stones are on some ridges. Areas are irregular in shape and 10 to more than 200 acres in size. They are 55 to 65 percent Okaton soil and 25 to 35 percent Lakoma soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Okaton soil is grayish brown, calcareous silty clay about 3 inches thick. The next 4 inches also is grayish brown, calcareous silty clay. The underlying material is light brownish gray, calcareous silty clay. Light brownish gray shale is at a depth of about 12 inches.

Typically, the surface layer of the Lakoma soil is grayish brown, calcareous silty clay about 5 inches thick. The subsoil is grayish brown, friable, calcareous silty clay about 12 inches thick. The underlying material is light olive brown, calcareous silty clay in which the content of shale fragments is about 30 percent. Pale yellow shale is at a depth of about 25 inches. In places the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Opal, Sansarc, and Schamber soils. These included soils make up less than 15 percent of any one mapped area. Opal and Sansarc soils are not so friable as the Okaton and Lakoma soils. They are on the low parts of the landscape. The excessively drained Schamber soils are very shallow over sand and gravel. They are on some ridges.

Organic matter content and fertility are low in the Okaton and Lakoma soils. Permeability is slow. Available water capacity is very low in the Okaton soil and low in the Lakoma soil. Runoff is rapid on both soils. The shrink-swell potential is high.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Gullies form along some cattle trails. Controlling livestock traffic patterns helps to prevent gullying. Some areas are potential sites for stock water impoundments, but seepage could be a problem. In some areas, mainly in the northwestern part of the county, the amount of woolly loco is sufficient to cause selenium poisoning in livestock. Timely deferment of grazing and rotation grazing help to prevent serious poisoning problems.

These soils are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Okaton soil is in capability unit VIIe-8, Shallow range site; the Lakoma soil is in capability unit VIe-4, Limy Clay range site; both soils are in windbreak suitability group 10.

Ok—Onita silt loam. This deep, moderately well drained, nearly level soil is in swales on uplands. It is occasionally flooded for brief periods. Areas are long and narrow or irregular shaped and are 5 to 50 acres in size. Slopes are smooth and slightly concave.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark gray silt loam about 14 inches thick. The subsoil is about 40 inches thick. It is dark grayish brown, firm silty clay in the upper part and grayish brown, calcareous silty clay loam in the lower part. It has accumulations of carbonate in the lower part. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Carter, Kolls, McClure, Millboro, and Reliance soils. These soils make up less than 15 percent of any one mapped area. Carter soils have a claypan subsoil. They are in positions on the landscape similar to those of the Onita soil. The poorly drained Kolls soils are in depressions. The well drained McClure, Millboro, and Reliance soils are slightly higher on the landscape than the Onita soil.

Organic matter content and fertility are high in the Onita soil. Tilth is good. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is at a depth of 2.5 to 6.0 feet. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture grasses. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage. In some years fieldwork is delayed because the soil receives runoff from the adjacent soils, but in most years the additional moisture is beneficial.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

The capability unit is IIc-3; Overflow range site; windbreak suitability group 1.

OlA—Opal clay, 0 to 3 percent slopes. This moderately deep, well drained, nearly level soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 140 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. It has accumulations of carbonate throughout. Gray shale is at a depth of about 32 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Hurley and Witten soils. These soils make up less than 10 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are on flats. The moderately well drained Witten soils are in swales.

Organic matter content is moderate and fertility medium in the Opal soil. Tilth is poor. Permeability is very slow. Available water capacity is low. Runoff is slow. The shrink-swell potential is very high.

About half of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to conserve moisture, improve tilth, and control wind erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, stripcropping, and including grasses and legumes in the cropping system. Chiseling and subsoiling increase the rate of water intake and improve tilth.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

OlB—Opal clay, 3 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and are 10 to more than 800 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. Gray shale is at a depth of about 32 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Hurley and Witten soils. These soils make up less than 10 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are on foot slopes. The moderately well drained Witten soils are in swales.

Organic matter content is moderate and fertility medium in the Opal soil. Tilth is poor. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay; however, it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling and subsoiling increase the rate of water intake and improve tilth. Contour farming and grassed waterways help to control erosion.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

OlC—Opal clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. Gray shale is at a depth of about 32 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Bullcreek, Chantier, and Sansarc soils. These soils make up less than 10 percent of any one mapped area. Bullcreek and Chantier soils contain more salts in the subsoil than the Opal soil. They are on the low parts of the landscape. Sansarc soils are 8 to 20 inches deep over shale. They are on ridges.

Organic matter content is moderate and fertility medium in the Opal soil. Tilth is poor. Permeability is very slow. Available water capacity is low. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Winter wheat is the main crop. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming and grassed waterways help to control erosion. Chiseling and subsoiling improve tilth and increase the rate of water intake. The soil generally is not suitable for terracing because the shale bedrock would be exposed in the terrace channel.

This soil is suited to windbreaks and environmental plantings; however, the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

OmC—Opal-Chantier clays, 2 to 9 percent slopes. These well drained, gently sloping and moderately sloping soils are on uplands. When dry, they are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The Opal soil is moderately deep, and the Chantier soil is shallow. Areas are irregular in shape and 10 to more than 500 acres in size. They are 50 to 60 percent Opal soil and 30 to 40 percent Chantier soil. The two soils occur as areas so closely intermingled that mapping them separately is not practical.

Typically, the surface layer of the Opal soil is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. Gray shale is at a depth of about 32 inches.

Typically, the surface layer of the Chantier soil is olive gray, calcareous clay about 2 inches thick. The subsoil is olive gray, very firm, calcareous clay about 13 inches thick. The underlying material is light olive gray, calcareous clay. The subsoil and underlying material have few to many accumulations of salts and gypsum. Gray shale is at a depth of about 19 inches.

Included with these soils in mapping are small areas of Bullcreek, Hurley, and Sansarc soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. The deep Bullcreek soils and the sodium affected Hurley soils are on foot slopes and along narrow drainageways. Sansarc soils do not have salts near the surface. They are on some ridges. Slickspots have a puddled surface. They support vegetation only during wet periods. They are in slight depressions.

Organic matter content is moderate and fertility medium in the Opal soil. Organic matter content and fertility are low in the Chantier soil. Tilth is poor in the Opal soil and very poor in the Chantier soil. Permeability is very slow in both soils. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns helps to prevent gullying. Reestablishing vegetation is difficult in denuded areas.

This map unit is suited to cultivated crops and to tame pasture and hay, but crop growth is restricted on the Chantier soil. Because the Chantier soil occurs in a random pattern throughout the unit, it is cropped with the Opal soil. The shallow depth to shale and the accumulations of salts near the surface are the main limitations in the Chantier soil. Examples of suitable pasture plants are intermediate wheatgrass and smooth bromegrass. Winter wheat is the main crop. Measures that help to control erosion, improve tilth, and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage. Contour farming and grassed waterways help to control erosion. Chiseling and subsoiling improve tilth.

The Opal soil is suited to windbreaks and environmental plantings, but the Chantier soil generally is unsuited. The clayey subsoil in the Opal soil can restrict the penetration of plant roots. Optimum growth is unlikely. Planting on the contour helps to control erosion and conserves moisture.

The Opal soil is in capability unit IVe-4, Clayey range site, and windbreak sutiability group 4C; the Chantier soil is in capability unit VIs-5, Dense Clay range site, and windbreak suitability group 10.

OnD—Opal-Sansarc clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Opal soil is on side slopes. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The shallow Sansarc soil is on ridges and sharp slope breaks. In some areas scattered stones are on the surface. Areas are irregular in shape and 10 to more than 2,000 acres in size. They are 50 to 60 percent Opal soil and 20 to 30 percent Sansarc soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Opal soil is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. It has accumulations of carbonate throughout. Gray shale is at a depth of about 32 inches. In places, the surface layer is not so dark and the soil contains less clay.

Typically, the Sansarc soil is grayish brown, calcareous clay to a depth of about 15 inches. Light olive gray shale is at a depth of about 15 inches.

Included with these soils in mapping are small areas of Bullcreek and Chantier soils. These included soils make up less than 15 percent of any one mapped area. They contain more salts throughout than the Opal and Sansarc soils. They are on foot slopes along drainageways.

Organic matter content is moderate and fertility medium in the Opal soil. Organic matter content and fertility are low in the Sansarc soil. Permeability is very slow in the Opal soil and slow in the Sansarc soil. Available water capacity is low in the Opal soil and very low in the Sansarc soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws; however, seepage could be a problem.

These soils generally are unsuited to cultivated crops, but moderately sloping areas of the Opal soil are suited. The slope of both soils and the shallow depth to shale in the Sansarc soil are the main limitations. Measures that help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and farming on the contour.

The Opal soil is suited to tame pasture and hay, but the Sansarc soil is unsuited. Intermediate wheatgrass and smooth bromegrass are examples of suitable pasture plants.

The Opal soil is suited to windbreaks and environmental plantings, but the Sansarc soil is unsuited. The clayey subsoil in the Opal soil can restrict the penetration of plant roots. Windbreaks can be established on this soil, but optimum growth is unlikely. Planting on the contour helps to control erosion and conserves moisture.

The Opal soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C; the Sansarc soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

OrB—Orton loam, 2 to 7 percent slopes. This well drained, gently sloping soil is on terraces. It is moderately deep over gravelly material. Areas are irregular in shape and 5 to more than 100 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 25 inches of dark grayish brown, grayish brown, and brown, very friable loam and fine sandy loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is yellowish brown gravelly loamy sand. In places the depth to gravelly material is more than 40 inches. In some areas the underlying material is loamy fine sand or fine sand.

Included with this soil in mapping are small areas of Lowry and Schamber soils. These soils make up less than 10 percent of any one mapped area. The silty Lowry soils are in positions on the landscape similar to those of the Orton soil. Schamber soils are less than 10 inches deep over gravelly material. They are on ridges.

Organic matter content is moderate and fertility medium in the Orton soil. Tilth is good. Permeability is moderately rapid in the upper part of the soil and rapid in the underlying material. Available water capacity is low. Runoff is medium.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay, but it is droughty. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Oats is the main crop. Measures that conserve moisture and help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings; however, optimum growth is unlikely because the soil is droughty.

The capability unit is IIIe-8; Sandy range site; windbreak suitability group 6G.

OtA—Orton Variant loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces.

Areas are irregular in shape and 30 to more than 100 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil is about 36 inches thick. It is brown and grayish brown, very friable, calcareous, stratified sandy loam, loamy sand, and sand. The underlying material to a depth of 60 inches is pale brown silt loam. In places gravelly sand is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Lowry and Valentine soils. These soils make up less than 10 percent of any one mapped area. The silty Lowry soils are in positions on the landscape similar to those of the Orton Variant soil. The excessively drained Valentine soils are on the high parts of the landscape.

Organic matter content is moderate and fertility medium in the Orton Variant soil. Tilth is good. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Oats is the main crop. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well.

The capability unit is IIIe-7; Sandy range site; windbreak suitability group 5.

OvB—Orton Variant-Valentine complex, 2 to 6 percent slopes. These deep, undulating soils are on terraces. The well drained Orton Variant soil is on the concave parts of the landscape. The excessively drained Valentine soil is on the convex parts. Areas are irregular in shape and 10 to more than 500 acres in size. They are about 55 to 65 percent Orton Variant soil and 25 to 35 percent Valentine soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Orton Variant soil is dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil is about 36 inches thick. It is grayish brown, very friable, calcareous, stratified sandy loam, loamy sand, and sand. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places gravelly sand is at a depth of 20 to 40 inches.

Typically, the surface layer of the Valentine soil is dark grayish brown fine sand about 4 inches thick. The next 10 inches is brown fine sand. The underlying material to a depth of 60 inches also is brown fine sand.

Included with these soils in mapping are small areas of Lowry and Schamber soils. These included soils make up less than 15 percent of any one mapped area. The silty Lowry soils are in positions on the landscape similar to those of the Orton Variant soil. Schamber soils are less than 10 inches deep over gravelly material. They are on ridges.

Organic matter content is moderate and fertility medium in the Orton Variant soil. Organic matter content and fertility are low in the Valentine soil. Tilth is good in the Orton Variant soil and poor in the Valentine soil. Permeability is moderately rapid in the Orton Variant soil and rapid in the Valentine soil. Available water capacity is moderate in the Orton Variant soil and low in the Valentine soil. Runoff is slow on both soils.

Most of the acreage supports native grasses and is used for grazing. Wind erosion is a hazard in overgrazed areas of the Valentine soil. Sand blowouts are common in these areas. Reestablishing vegetation is difficult in denuded areas of the Valentine soil.

Although the Orton Variant soil is suited to cultivated crops and to tame pasture and hay, this map unit generally is unsuited to these uses because of the sandy, infertile Valentine soil. Establishing a stand of plants is difficult because seedlings are damaged by windblown sand when wind erosion occurs on the Valentine soil.

These soils are suited to windbreaks and environmental plantings, but the Valentine soil is suited only to evergreen trees and shrubs. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Orton Variant soil. Planting directly in sod helps to control wind erosion.

The Orton Variant soil is in capability unit IIIe-8, Sandy range site, and windbreak suitability group 5; the Valentine soil is in capability unit VIe-7, Sands range site, and windbreak suitability group 7.

Pg—Pits, gravel. These areas are open excavations, 5 to 30 feet deep, from which sand and gravel are being removed. They are irregular in shape and 5 to 30 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottoms to almost vertical on the rims.

The pit bottoms typically are sand and gravel, but they are clay or shale in areas where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of the excavations. The bottoms and sides support little or no vegetation during periods when the pits are mined.

Most gravel pits can be used only as a source of sand and gravel for construction purposes. Some provide

limited wildlife habitat. Abandoned gravel pits can be restored to range or tame pasture if reclamation measures are applied. These measures include shaping the areas and topdressing with the mounds of overburden material. Applying fertilizer as needed helps to establish range or pasture plants.

The capability unit is VIIIs-2; no range site or windbreak suitability group is assigned.

PoA—Promise clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands and foot slopes. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 1,200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous clay about 7 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 28 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum throughout. In places the soil contains less clay throughout. In some areas shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Carter, Hurley, and Witten soils. These soils make up less than 10 percent of any one mapped area. Carter and Hurley soils have a claypan subsoil. They are on flats or in slight depressions. Witten soils are dark to a depth of more than 20 inches. They are in swales.

Organic matter content is moderate and fertility medium in the Promise soil. Tilth is poor. Permeability is very slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay; however, it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that conserve moisture, help to control wind erosion, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, including grasses and legumes in the cropping system, and stripcropping. Chiseling and subsoiling improve tilth and increase the rate of water intake.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

PoB—Promise clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to more than 500 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous clay about 7 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 28 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum throughout. In places the soil contains less clay throughout. In some areas shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Carter, Hurley, and Witten soils. These soils make up less than 10 percent of any one mapped area. Carter and Hurley soils have a claypan subsoil. They are on flats or in slight depressions. Witten soils are dark to a depth of more than 20 inches. They are in swales.

Organic matter content is moderate and fertility medium in the Promise soil. Tilth is poor. Permeability is very slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay; however, it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, stripcropping, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling and subsoiling improve tilth and increase the rate of water intake. Grassed waterways help to control erosion.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

PoC—Promise clay, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous clay about 7 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 28 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum throughout. In places the soil contains less clay throughout. In some areas shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Bullcreek, Hurley, and Sansarc soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Bullcreek and Hurley soils are on foot slopes and in nearly level areas. They have visible salts in the upper part of the subsoil. Also, Hurley soils have a claypan subsoil. Sansarc soils are 8 to 20 inches deep over shale. They are on ridges and sharp slope breaks.

Organic matter content is moderate and fertility medium in the Promise soil. Tilth is poor. Permeability is very slow. Available water capacity is moderate. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Water erosion is a hazard in overgrazed areas.

This soil is suited to cultivated crops and to tame pasture and hay; however, it becomes compacted if farmed when wet and is difficult to till when dry. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that help to control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways help to control erosion. Chiseling and subsoiling increase the rate of water intake and improve tilth.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

PrA—Promise-Hurley complex, 0 to 4 percent slopes. These deep, nearly level and gently sloping soils are on uplands. The well drained Promise soil is in smooth and slightly convex areas. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The moderately well drained, sodium affected Hurley soil is in shallow depressions and on low side slopes. Areas are irregular in shape and 5 to more than 400 acres in size. They are 50 to 60 percent Promise soil and 25 to 35 percent Hurley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Promise soil is grayish brown, calcareous clay about 7 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 28 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum throughout. In places the soil contains less clay throughout.

Typically, the surface layer of the Hurley soil is gray silt loam about 2 inches thick. The subsoil is dark gray, olive gray, and grayish brown, very firm, calcareous clay about 31 inches thick. It has accumulations of carbonate and nests of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum and other salts throughout. In some areas shale is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Carter, Kolls, and Witten soils. These included soils make up less than 10 percent of any one mapped area. Carter soils are in positions on the landscape similar to those of the Hurley soil. Their subsoil has a lower content of visible salts than that of the Hurley soil. The poorly drained Kolls soils are in depressions. Witten soils do not have a sodium affected subsoil. They are in swales.

Organic matter content is moderate and fertility medium in the Promise soil. Organic matter content and fertility are low in the Hurley soil. Tilth is poor in both soils. Permeability is very slow. Available water capacity is moderate in the Promise soil and low in the Hurley soil. Runoff is slow on both soils. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing or hay. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This map unit is suited to cultivated crops and to tame pasture and hay, but crop growth is severely restricted on the Hurley soil. Because the Hurley soil occurs in a random pattern throughout the unit, it is cropped with the Promise soil. The dense claypan subsoil near the surface and the salts in the subsoil severely restrict root penetration and the rate of water intake in the Hurley soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are examples of

suitable pasture plants on the Promise soil. No pasture plants are suited to the Hurley soil. Winter wheat is the main crop. Measures that help to control wind erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, stripcropping, and including grasses and legumes in the cropping system. Chiseling and subsoiling improve tilth and increase the rate of water intake.

The Promise soil is suited to windbreaks and environmental plantings, but the Hurley soil is generally unsuited. The clayey subsoil in the Promise soil can restrict the penetration of plant roots. Windbreaks can be established on the Promise soil, but no trees or shrubs grow well on the Hurley soil.

The Promise soil is in capability unit IIIs-3, Clayey range site, and windbreak suitability group 4C; the Hurley soil is in capability unit VIs-1, Thin Claypan range site, and windbreak suitability group 10.

ReB—Ree silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces. Areas are irregular in shape and 5 to 80 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, friable clay loam in the upper part and light brownish gray, friable, calcareous clay loam and loam in the lower part. The lower part has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In places sand and gravel are at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Reliance soils. These soils make up less than 10 percent of any one mapped area. They contain more clay and less sand in the subsoil than the Ree soil. They are in positions on the landscape similar to those of the Ree soil.

Organic matter content is moderate and fertility medium in the Ree soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

About half of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture and help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming also helps to control erosion.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

ReC—Ree silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces. Areas are irregular in shape and 5 to 30 acres in size. Slopes are slightly convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, friable clay loam in the upper part and light brownish gray, friable, calcareous clay loam and loam in the lower part. The lower part has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In places sand and gravel are at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Reliance and Schamber soils. These soils make up less than 10 percent of any one mapped area. Reliance soils have more clay and less sand in the subsoil than the Ree soil. They are in positions on the landscape similar to those of the Ree soil. Schamber soils are less than 10 inches deep over gravelly material. They are on ridges.

Organic matter content is moderate and fertility medium in the Ree soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range; however, water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture and help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming,

terraces, and grassed waterways also help to control erosion.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

RIA—Reliance silty clay loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 5 to 90 acres in size. Slopes are long and smooth.

Typically, the surface soil is dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 34 inches thick. It is grayish brown, brown, and light brownish gray, firm silty clay and friable silty clay loam. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is pale brown, calcareous silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Kolls, Onita, and Ree soils. These soils make up less than 10 percent of any one mapped area. The poorly drained Kolls soils are in depressions. The moderately well drained Onita soils are in swales. Ree soils contain less clay and more sand throughout than the Reliance soil. They are in positions on the landscape similar to those of the Reliance soil.

Organic matter content is moderate and fertility medium in the Reliance soil. Tilth is fair. Permeability is moderately slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well.

The capability unit is IIc-2; Silty range site; windbreak suitability group 3.

RIB—Reliance silty clay loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to more than 200 acres in size. Slopes are long and smooth.

Typically, the surface soil is dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 34 inches thick. It is grayish brown, brown, and light brownish gray, firm silty clay and friable silty clay loam. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is pale brown, calcareous silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Kolls, Millboro, Onita, and Ree soils. These soils make up less than 10 percent of any one mapped area. The poorly drained Kolls soils are in depressions. Millboro and Ree soils are in positions on the landscape similar to those of the Reliance soil. Millboro soils contain more clay throughout than the Reliance soil. Ree soils contain less clay and more sand in the subsoil than the Reliance soil. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the Reliance soil. Tilth is fair. Permeability is moderately slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that conserve moisture and help to control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming helps to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3.

RIC—Reliance silty clay loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 5 to more than 150 acres in size. Slopes are smooth.

Typically, the surface soil is dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 34 inches thick. It is grayish brown, brown, and light brownish gray, firm silty clay and friable silty clay loam. In the lower part it is calcareous and has accumulations

of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is pale brown, calcareous silty clay loam. In places the subsoil contains less clay. In some areas the surface soil is less than 6 inches thick.

Included with this soil in mapping are small areas of Millboro, Onita, and Ree soils. These soils make up less than 10 percent of any one mapped area. Millboro and Ree soils are in positions on the landscape similar to those of the Reliance soil. Millboro soils contain more clay throughout than the Reliance. Ree soils contain less clay and more sand in the subsoil than the Reliance soil. The moderately well drained Onita soils are in swales.

Organic matter content is moderate and fertility medium in the Reliance soil. Tilth is fair. Permeability is moderately slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Corn, oats, grain sorghum, and winter wheat are the main crops. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways also help to control erosion.

No major hazards or limitations affect the use of this soil for range; however, water erosion is a hazard if the range is overgrazed. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

RsE—Rock outcrop-Sansarc complex, 9 to 40 percent slopes. This map unit occurs as areas of Rock outcrop intermingled with areas of a shallow, well drained, strongly sloping to steep Sansarc soil. It is on uplands. Landslides are common on the steeper slopes. The Rock outcrop generally is on ridges and on the steep, convex parts of the landscape. The Sansarc soil is on smooth side slopes. Areas are irregular in shape and 10 to more than 500 acres in size. They are 60 to 75 percent Rock outcrop and 20 to 35 percent Sansarc soil. The Rock outcrop and the Sansarc soil occur as areas so closely intermingled or so small that mapping them separately is not practical.

The Rock outcrop is gray shale of the Pierre Formation. It supports no vegetation. Scattered manganese and iron concretions are on the surface in most areas.

Typically, the Sansarc soil is grayish brown, calcareous clay to a depth of about 15 inches. The surface layer is about 3 inches thick. In the next 5 inches, the content of shale fragments is about 20 percent. In the underlying material, it is about 55 percent. Light olive gray shale is at a depth of about 15 inches.

Included with the Rock outcrop and Sansarc soil in mapping are small areas of Bullcreek and Chantier soils. These included soils make up less than 15 percent of any one mapped area. The deep Bullcreek soils are on foot slopes and along narrow drainageways. Chantier soils have visible salts in the subsoil. They are on the less sloping side slopes.

Organic matter content and fertility are low in the Sansarc soil. Permeability is slow. Available water capacity is very low. Runoff is very rapid. The shrink-swell potential is very high.

All areas are used for grazing. The Rock outcrop does not support grazable vegetation. Water erosion is a hazard. Gullies form along some cattle trails. Reestablishing vegetation is difficult. Cedar trees in some draws provide protection for livestock and wildlife.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop is an additional limitation.

The Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group; the Sansarc soil is in capability unit VIIe-8, Shallow Clay range site, and windbreak suitability group 10.

SaE—Sansarc clay, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on uplands. Scattered stones are on the surface in places. Areas are irregular in shape and 15 to more than 1,500 acres in size. Slopes are smooth or slightly convex.

Typically, the soil is grayish brown, calcareous clay to a depth of about 15 inches. The surface layer is about 3 inches thick. In the next 5 inches, the content of shale fragments is about 20 percent. In the underlying material, it is about 55 percent. Light olive gray shale is at a depth of about 15 inches.

Included with this soil in mapping are small areas of Bullcreek, Chantier, and Opal soils and areas of Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The deep Bullcreek soils are on foot slopes and along drainageways. Chantier and Opal soils are on the less sloping side slopes. Chantier soils have visible salts in the subsoil. Opal soils are 20 to 40 inches deep over shale. The Rock outcrop consists of exposures of shale bedrock in a random pattern throughout the map unit.

Organic matter content and fertility are low in the Sansarc soil. Permeability is slow. Available water

capacity is very low. Runoff is very rapid. The shrink-swell potential is very high.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to control gullying. Reestablishing vegetation is difficult in denuded areas. Native trees, shrubs, and brush grow in some draws and drainageways. Cedar trees in some of the deep draws along Lake Francis Case and Lake Sharpe provide protection for livestock and wildlife. Some areas are potential sites for stock water impoundments, but seepage is a problem.

This soil is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIIe-8; Shallow Clay range site; windbreak suitability group 10.

SbE—Sansarc-Opal clays, 9 to 40 percent slopes. These well drained, strongly sloping to steep soils are in areas on uplands where drainageways are deeply entrenched. Scattered large stones are on the surface in some areas. The shallow Sansarc soil is on the upper, convex parts of the landscape. The moderately deep Opal soil is on the lower and middle side slopes. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 15 to more than 2,000 acres in size. They are 45 to 55 percent Sansarc soil and 35 to 45 percent Opal soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the Sansarc soil is grayish brown, calcareous clay to a depth of about 15 inches. The surface layer is about 3 inches thick. In the next 5 inches, the content of shale fragments is about 20 percent. In the underlying material, it is about 55 percent. Light olive gray shale is at a depth of about 15 inches.

Typically, the surface layer of the Opal soil is dark gray clay about 5 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 22 inches thick. The underlying material is grayish brown clay. It has accumulations of carbonate throughout. Gray shale is at a depth of about 32 inches.

Included with these soils in mapping are small areas of Bullcreek and Chantier soils and areas of Rock outcrop. These inclusions make up less than 10 percent of any one mapped area. The deep Bullcreek and shallow Chantier soils contain more salts throughout than the Sansarc and Opal soils. Bullcreek soils are on foot slopes and along drainageways. Chantier soils are in positions on the landscape similar to those of the Opal soil. The Rock outcrop occurs in a random pattern throughout areas of the Sansarc soil. It does not support grazable vegetation.

Organic matter content and fertility are low in the Sansarc soil. Organic matter content is moderate and fertility medium in the Opal soil. Permeability is slow in the Sansarc soil and very slow in the Opal soil. Available water capacity is very low in the Sansarc soil and low in the Opal soil. Runoff is very rapid on both soils. The shrink-swell potential is very high.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Gullies form along some cattle trails. Reestablishing vegetation is difficult in denuded areas. Cedar trees in some draws provide protection for livestock and wildlife. Many areas are potential sites for stock water impoundments (fig. 7).

These soils are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Sansarc soil is in capability unit VIIe-8, Shallow Clay range site; the Opal soil is in capability unit VIe-4, Clayey range site; both soils are in windbreak suitability group 10.

ScE—Sansarc-Rock outcrop complex, 9 to 40 percent slopes. This map unit occurs as areas of a shallow, well drained, strongly sloping to steep Sansarc soil intermingled with areas of Rock outcrop. It is on uplands that generally are dissected by narrow drainageways (fig. 8). The Sansarc soil is on the smooth parts of the landscape. The Rock outcrop generally is on ridges and on the steep, convex parts of the landscape. Areas are irregular in shape and 10 to more than 1,000 acres in size. They are 45 to 60 percent Sansarc soil and 25 to 40 percent Rock outcrop. The Sansarc soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the Sansarc soil is grayish brown, calcareous clay to a depth of about 15 inches. The surface layer of about 3 inches thick. In the next 5 inches, the content of shale fragments is about 20 percent. In the underlying material, it is about 55 percent. Light olive gray shale is at a depth of about 15 inches.

The Rock outcrop is gray shale of the Pierre Formation. It supports no vegetation. Scattered manganese and iron concretions are on the surface in most areas.

Included with the Sansarc soil and Rock outcrop in mapping are small areas of Bullcreek, Chantier, and Opal soils. These included soils make up less than 15 percent of any one mapped area. The deep Bullcreek soils are on foot slopes along narrow drainageways. Chantier and Opal soils are on the low side slopes. Chantier soils have visible salts in the subsoil. Opal soils are 20 to 40 inches deep over shale.

Organic matter content and fertility are low in the Sansarc soil. Permeability is slow. Available water

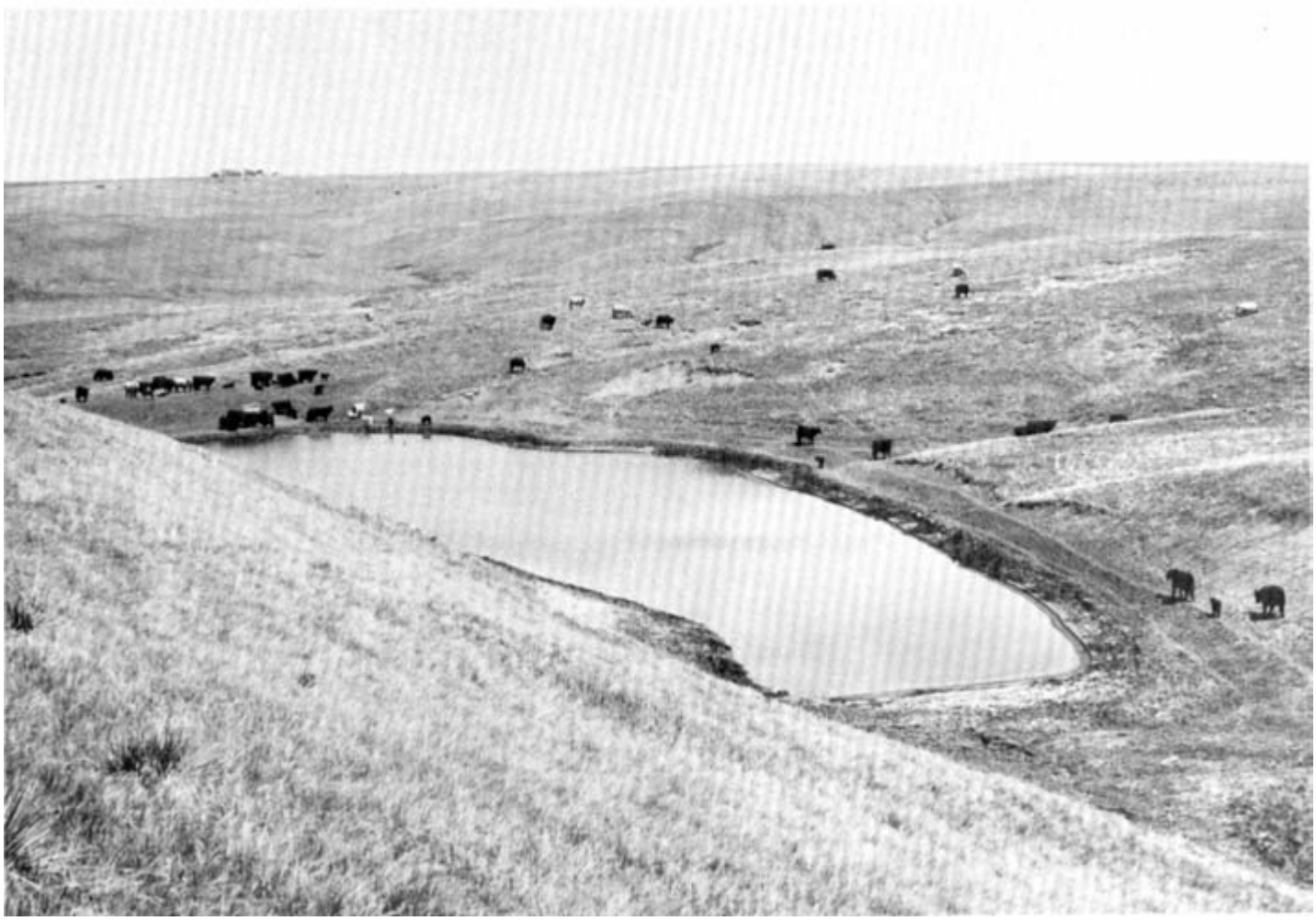

Figure 7.—A stock water impoundment in an area of Sansarc-Opal clays, 9 to 40 percent slopes.

capacity is very low. Runoff is very rapid. The shrink-swell potential is very high.

All areas of the Sansarc soil support native grasses and are used for grazing. The Rock outcrop does not support grazable vegetation. Water erosion is a hazard unless an adequate plant cover is maintained. Gullies form along some cattle trails. Reestablishing vegetation is difficult. Cedar trees in some draws provide protection for livestock and wildlife.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop is an additional limitation.

The Sansarc soil is in capability unit VIIe-8, Shallow Clay range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group.

SeE—Sansarc-Schamber complex, 9 to 40 percent slopes. These strongly sloping to steep soils are on uplands. The well drained, shallow Sansarc soil is on side slopes. The excessively drained Schamber soil is on ridges. It is very shallow over gravelly material. Areas are irregular in shape and 10 to more than 100 acres in size. They are 50 to 60 percent Sansarc soil and 30 to 40 percent Schamber soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the Sansarc soil is grayish brown, calcareous clay to a depth of about 15 inches. The surface layer is about 3 inches thick. In the next 5 inches, the content of shale fragments is about 20 percent. In the underlying material, it is about 55 percent. Light olive gray shale is at a depth of about 15 inches.

Typically, the surface layer of the Schamber soil is brown loam about 5 inches thick. The underlying material

Figure 8.—An area of Sansarc-Rock outcrop complex, 9 to 40 percent slopes.

to a depth of 60 inches is multicolored, calcareous gravelly and very gravelly loamy sand. In places clayey material is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Bullcreek and Opal soils. These included soils make up less than 20 percent of any one mapped area. The deep, clayey Bullcreek soils are on foot slopes and in drainageways. Opal soils are 20 to 40 inches deep over shale. They are on low side slopes.

Organic matter content and fertility are low in the Sansarc and Schamber soils. Permeability is slow in the Sansarc soil and rapid in the Schamber soil. Available water capacity is very low in both soils. Runoff is very rapid. The shrink-swell potential is very high in the Sansarc soil and low in the Schamber soil.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The shallow depth to bedrock or gravel and the slope are the main limitations. The Schamber soil is a probable source of sand and gravel.

The Sansarc soil is in capability unit VIIe-8, Shallow Clay range site; the Schamber soil is in capability unit VIIs-4, Very Shallow range site; both soils are in windbreak suitability group 10.

ShE—Schamber loam, 6 to 40 percent slopes. This excessively drained, moderately sloping to steep soil is on ridges, knolls, and terrace escarpments. It is very shallow over gravelly material. Areas are long and narrow and are 10 to more than 100 acres in size. Slopes are short and convex.

Typically, the surface layer is brown loam about 5 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly and very gravelly loamy sand. In places clayey material is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Lowry, Orton, Sansarc, and Sully soils. These soils make up less than 15 percent of any one mapped area. Lowry, Orton, and Sully soils are on the high parts of the landscape. The silty Lowry and Sully soils are not underlain by gravelly material. Orton soils are 20 to 40 inches deep over gravelly material. The clayey Sansarc soils are 8 to 20 inches deep over shale. They are slightly lower on the landscape than the Schamber soil.

Organic matter content and fertility are low in the Schamber soil. Permeability is rapid. Available water capacity is very low. Runoff is rapid.

All of the acreage supports native grasses and is used for grazing. Productivity is limited because the soil is droughty. Reestablishing vegetation is difficult. Maintaining an adequate plant cover helps to prevent excessive erosion.

This soil is too droughty and too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It is a probable source of sand and gravel.

The capability unit is VIIs-4; Very Shallow range site; windbreak suitability group 10.

SlE—Sully silt loam, 15 to 40 percent slopes. This deep, well drained, moderately steep and steep soil is on uplands. Areas are irregular in shape and 5 to 60 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The next 15 inches is light brownish gray, calcareous silt loam. The underlying material to a depth of 60 inches also is light brownish gray, calcareous silt loam.

Included with this soil in mapping are small areas of Sansarc and Schamber soils. These soils make up less than 10 percent of any one mapped area. Sansarc soils are 8 to 20 inches deep over shale. They are slightly lower on the landscape than the Sully soil. The excessively drained Schamber soils are less than 10 inches deep over gravelly material. They are on terrace scarps.

Organic matter content and fertility are low in the Sully soil. Permeability is moderate. Available water capacity is high. Runoff is rapid.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult.

This soil is too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIIe-3; Thin Upland range site; windbreak suitability group 10.

VaD—Valentine fine sand, 6 to 25 percent slopes. This deep, gently rolling to hilly, excessively drained soil is on terraces. Areas are irregular in shape and 10 to more than 250 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown fine sand about 4 inches thick. The next 10 inches is brown fine sand. The underlying material to a depth of 60 inches also is brown fine sand.

Included with this soil in mapping are small areas of Orton Variant and Schamber soils. These soils make up less than 15 percent of any one mapped area. The well drained Orton Variant soils are on the low, concave parts of the landscape. Schamber soils are less than 10 inches deep over gravelly material. They are on knolls and ridges.

Organic matter content and fertility are low in the Valentine soil. Permeability is rapid. Available water capacity is low. Runoff is slow.

All of the acreage supports native grasses and is used for grazing. Wind erosion is a hazard unless an adequate plant cover is maintained. Sand blowouts are likely to form in overgrazed areas. Reestablishing vegetation is difficult.

This soil generally is too sandy for cultivated crops and tame pasture and hay, but it is suited to evergreen trees and shrubs. Planting directly in sod helps to control wind erosion.

The capability unit is VIe-7; Sands range site; windbreak suitability group 7.

Wd—Wendte silty clay, channeled. This deep, moderately well drained, nearly level soil is on flood plains that are dissected into many small tracts by narrow channels. It is frequently flooded for brief periods. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend into the underlying material. Areas are long and narrow and are 10 to more than 400 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silty clay about 5 inches thick. The underlying material to a depth of 60 inches is grayish brown, stratified, calcareous silty clay, clay, clay loam, and silty clay loam.

Included with this soil in mapping are small areas of Bullcreek, Opal, and Promise soils. These soils make up less than 15 percent of any one mapped area. They are on uplands and foot slopes near the flood plains. Bullcreek and Promise soils are not stratified. Opal soils are 20 to 40 inches deep over shale.

Organic matter content is moderate and fertility medium in the Wendte soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Although the soil is frequently flooded, the additional water is beneficial. Pools of water in some areas of the channels are temporary watering sites for livestock and wildlife. Native trees and shrubs in some areas provide habitat for wildlife and winter protection for livestock.

Because of the meandering channels, this soil generally is unsuited to cultivated crops. It is suited to tame pasture and hay in areas that are accessible to farm machinery. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants. Debris deposited by floodwater in some years damages pasture plants and hinders haying.

This soil is suited to windbreaks and environmental plantings, but it takes in water slowly and the clayey underlying material can restrict the penetration of plant roots. Because of the meandering stream channels, the trees and shrubs generally cannot be planted by machine. They can be planted by hand.

The capability unit is VIw-1; Clayey Overflow range site; windbreak suitability group 4C.

Wt—Witten silty clay. This deep, moderately well drained, nearly level soil is in swales on uplands. It is occasionally flooded for very brief periods. When dry, it is characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are long and narrow or irregularly shaped. They are 10 to 200 acres in size. Slopes are long and are smooth or slightly concave.

Typically, the surface layer is dark grayish brown, calcareous silty clay about 8 inches thick. The subsoil is dark grayish brown and grayish brown, firm, calcareous clay about 26 inches thick. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has nests of gypsum and other salts throughout.

Included with this soil in mapping are small areas of Carter, Hurley, Kolls, Millboro, and Promise soils. These soils make up less than 15 percent of any one mapped area. Carter and Hurley soils have a claypan subsoil. They are in positions on the landscape similar to those of the Witten soil. The poorly drained Kolls soils are in depressions. The well drained Millboro and Promise soils are slightly higher on the landscape than the Witten soil.

Organic matter content and fertility are high in the Witten soil. Tilth is poor. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Grain sorghum and winter wheat are the main crops. Measures that conserve moisture during dry periods, help to control wind erosion, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Subsoiling and chiseling also improve tilth.

If this soil is used for range, surface compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

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 and 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 inputs 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 Soil Conservation Service.

About 14,640 acres in Lyman County, or 1.4 percent of the total land area, meets the soil requirements for

prime farmland. This includes about 7,040 acres of irrigated land. About 314,785 additional acres would meet the requirements for prime farmland if irrigated. The main crops grown on this land are corn and alfalfa.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5 and in the section "Interpretive Groups," which follows the tables at the back of this survey. 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 for 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 this limitation has been overcome in specific areas.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the county are assigned to various interpretive groups at the end of each map unit description. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 36 percent of the acreage in Lyman County is used for cultivated crops or for tame pasture and hay (*3*). The major crops are alfalfa, oats, grain sorghum, and winter wheat. Alfalfa is grown mainly for hay; however, some seed is harvested as a cash crop. Oats and grain sorghum are grown mainly as cash crops but in some areas are used as livestock feed. Winter wheat is the main cash crop in the county.

The potential of the soils in the county for increased crop production is good. In 1975, about 112,000 acres of potentially good cropland was used as range (*11*). Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the major concerns in managing the cropland in the county. These concerns are water erosion, wind erosion, fertility, and tilth.

Water erosion reduces productivity and results in sedimentation in streams and lakes. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Boro, Lakoma, and Sully soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Orton and Opal soils. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize the pollution of streams and lakes by sediment and preserve water quality for fish and wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas and prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing

tillage and leaving crop residue on the surface increase the water infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions help to control erosion by reducing the length of slopes and the runoff rate. They are most practical on deep, well drained soils that have long, smooth slopes, such as Millboro and Promise soils. Contour farming and contour stripcropping also are effective on these soils. Some soils, such as Opal, are poorly suited to terraces and diversions because of short, irregular slopes and an unfavorable subsoil, which would be exposed in the terrace channels.

Wind erosion is a slight to severe hazard on many of the soils in Lyman County. The hazard is especially severe on sandy soils, such as Inavale and Valentine soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface help to control wind erosion. Windbreaks of suitable trees and shrubs also are effective.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soil. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on Boro and other soils that have a high content of lime in the surface layer generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. On all soils additions of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. In Opal and Promise soils, tilth is poor. These soils dry out slowly in the spring and cannot be easily tilled when wet. If they are farmed when wet, they tend to be cloddy when dry. As a result of the cloddiness, preparing a good seedbed is difficult. Timely tillage, inclusion of grasses and legumes in the cropping system, and incorporation of crop residue into the soil improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the county include close-grown crops and row crops. Oats and winter wheat are the main close-grown crops. Grain sorghum and corn are the main row crops.

Deep, well drained or moderately well drained soils are suited to all of the crops commonly grown in the county. Examples are Agar, Lowry, McClure, Millboro, and Mobridge soils. Orton and other droughty soils are better suited to early maturing small grain than to the deeper rooted crops, such as corn and alfalfa, because the porous underlying material limits the depth to which roots can penetrate and the available water capacity. Promise and Opal soils are better suited to winter wheat and grain sorghum than to corn.

Many of the deep, well drained soils are suitable for irrigation. Examples are Agar, Lowry, and Ree soils. The main management concerns are conserving moisture and improving fertility and tilth in all irrigated soils and controlling erosion on soils that have a slope of more than 2 percent. The quality of the irrigation water is a concern if water from a well is used. The best water has a low content of salts and sodium.

Pasture plants best suited to the climate and to most of the soils in the county include alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Orton and other droughty soils are well suited to crested wheatgrass. Because of the hazard of erosion, bunchgrasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent. On the poorly drained Hoven and Kolls soils, the choice of pasture plants is limited to water-tolerant species, such as Garrison creeping foxtail, reed canarygrass, and western wheatgrass.

If the pasture is overgrazed, the grasses lose vigor and usually are replaced by annual grasses and weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed.

The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*9*). These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-4. The capability units are not numbered consecutively because the ones represented in the county do not include all of the units in the statewide system.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of this survey.

Rangeland

Maurice R. Davis, range conservationist, Soil Conservation Service, prepared this section.

Rangeland supports native vegetation suitable for grazing or browsing. It includes areas where native vegetation has been reestablished. The vegetation is mainly grasses, grasslike plants, forbs, or shrubs. The amounts and kinds of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

All of the county was rangeland before the first permanent settlers arrived. Currently, about 63 percent of the county supports native vegetation. This rangeland supplies a major portion of the forage for livestock in the county. Approximately 53 percent of the farm and ranch income in the county is derived from the sale of livestock and livestock products. Most of the ranches are cow-calf operations. Some are yearling operations, and some ranchers combine their cow herds with yearlings. This practice permits greater flexibility in adjusting livestock numbers during periods of drought. The rangeland generally is grazed from May through October. The forage provided by rangeland generally is supplemented by crop aftermath and tame pasture plants, such as crested wheatgrass and smooth bromegrass. In winter it is supplemented by protein concentrate and hay.

Lyman County is part of the mixed grass prairie (*7*). The native vegetation is dominated by mid grasses and

forbs, but tall and short grasses and forbs are interspersed with these plants. The mixed grass prairie consists of cool- and warm-season plants, which provide good-quality forage throughout the growing season. The cool-season plants grow mostly during April, May, and June and the warm-season plants during June, July, and August. The cool-season grasses may start growing again in September and October if autumn rainfall is adequate.

The native vegetation in some parts of the county is producing below its potential because of past misuse. The tall grasses and some of the mid grasses have been replaced by less desirable plants. The result is a total reduction of available forage. In most areas, however, enough of the original plants remain for good grazing management to reestablish the high-quality plants.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential native vegetation on a range site is the stabilized plant community that the site is capable of producing. It consists of the plants that were growing on the site when the region was settled. This plant community maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during this survey; thus range sites generally can be determined directly from the soil map.

The plants within the native plant community are sometimes grouped as decreasers, increasers, or invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to overgrazing by decreasing in abundance. They generally are the most productive plants and the ones most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure, at least initially, by increasing in amount as the more desirable decreaser plants become less abundant. Increasers generally are less productive and less preferred by grazing animals. *Invaders* are plants that are not part of the original plant community but invade because of some kind of disturbance or continued overgrazing. Some invader plants have little value for grazing.

Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others. A cool-season plant, for example, may be a decreaser if the site is grazed only during the spring but would be an increaser if the same site were grazed only during the summer. The reverse would be true for the warm-season plants. Restricting grazing to the spring would cause the warm-season plants to increase in abundance, and restricting grazing to the summer would cause them to decrease.

Table 7 shows, for nearly all the soils, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management maintains the capacity of the rangeland to produce forage for livestock and game animals and to provide wildlife habitat, water, and watershed protection. The primary objective of good range management is to keep the rangeland in excellent or good condition. The main management concern is responding to important changes in the plant community of a range site.

Range condition is determined by comparing the present vegetation on a range site with the potential native plant community for the site. Four range condition classes are recognized. The range site is in excellent condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less. The potential production depends on the range site, the range condition, and the moisture available to plants during the growing season.

Measures that maintain or improve the range condition are needed on all the rangeland in the county. They include proper stocking rates and rotation grazing or deferred grazing programs, which allow for the proper sequence of grazing and provide rest periods that maintain or improve the vigor of the key plants. Good range management also includes range seeding, fencing, and measures that provide water for livestock. Contour furrowing, pitting, deep chiseling, and other kinds of mechanical treatment are needed on some range sites.

The soils in the county are assigned to 16 different range sites. The names of these sites are Clayey, Clayey

Overflow, Claypan, Closed Depression, Dense Clay, Limy Clay, Overflow, Sands, Sandy, Shallow, Shallow Clay, Shallow Marsh, Silty, Thin Claypan, Thin Upland, and Very Shallow. The paragraphs that follow describe these range sites.

Clayey range site. The potential native vegetation on this site is mid and short prairie grasses interspersed with a variety of forbs. Green needlegrass and western wheatgrass, which are cool-season grasses, make up about 70 percent of the vegetation. Warm-season grasses, such as sideoats grama, blue grama, and buffalograss, make up about 25 percent. Forbs, such as heath aster, prairie coneflower, yarrow, sagewort, false-boneset, and scarlet globemallow, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. Green needlegrass and sideoats grama rapidly decrease in amount after continued overgrazing because the livestock prefer these plants. The amount of western wheatgrass initially increases after overuse. It decreases, however, if overuse continues. After continued overgrazing, the amount of blue grama and buffalograss increases and that of the taller grasses decreases. A less productive site dominated by short grasses is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by a grazing management system that provides rest periods during the key growing seasons of these plants.

Clayey Overflow range site. The potential native vegetation on this site is mid prairie grasses. Western wheatgrass and green needlegrass, which are cool-season grasses, make up about 80 percent of the vegetation. Short grasses, such as blue grama and buffalograss, make up about 15 percent, and forbs and sedges make up about 5 percent.

The major management concern on this site is maintaining the amount of the most productive grasses. Green needlegrass rapidly decreases in amount after continued overgrazing because the livestock prefer this grass. As the amount of this grass decreases, the amount of western wheatgrass initially increases. After continuous overgrazing, short, warm-season grasses, such as blue grama and buffalograss, become the principal plants on the site. Low forage production is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing. Other management practices include a combination of contour furrowing and pitting.

Claypan range site. The potential native vegetation on this site is a mixture of mid and short prairie grasses interspersed with some forbs. Western wheatgrass, needleandthread, and green needlegrass, which are cool-season grasses, make up about 65 percent of the vegetation. Blue grama, buffalograss, and sideoats grama, which are warm-season grasses, make up about 25 percent. Sedges, which are grasslike plants, and forbs make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continuous overgrazing, the amount of green needlegrass, western wheatgrass, needleandthread, and sideoats grama decreases. The amount of blue grama and buffalograss increases. Low forage production is the result. The amount of the most productive grasses can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

Closed Depression range site. The potential native vegetation on this site is about 85 percent western wheatgrass and 10 percent sedges. The plant community is not stable, however, because of alternating wet and dry periods. This site, which is on the plane or concave bottoms of closed depressions, is excessively wet or ponded during wet periods and is droughty during abnormally dry periods.

The main management concern on this site is maintaining the amount of western wheatgrass. After continued overgrazing, the amount of short grasses, such as saltgrass and Kentucky bluegrass, increases and that of western wheatgrass decreases. Low forage production is the result. Trampling by livestock results in surface compaction and thus in deterioration of the site. The amount of western wheatgrass can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Dense Clay range site. The potential native vegetation on this site is mid prairie grasses interspersed with forbs. Western wheatgrass and green needlegrass, which are cool-season grasses, make up about 90 percent of the vegetation. Forbs, such as wild onion, make up about 10 percent. Short grasses do not grow on this site.

The major management concern on this site is maintaining the amount of green needlegrass and western wheatgrass. After continued overgrazing and trampling by livestock, these grasses are replaced by unpalatable plants and the surface is bare in spots. The bare areas are susceptible to erosion. The amount of green needlegrass and western wheatgrass can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

Limy Clay range site. The potential native vegetation on this site is mixed prairie grasses. Porcupinegrass,

green needlegrass, and western wheatgrass, which are cool-season grasses, make up about 45 percent of the vegetation. Warm-season grasses make up about 40 percent. Big bluestem is the dominant warm-season grass. Significant amounts of sideoats grama, little bluestem, and prairie sandreed also grow on the site. Forbs, such as silverleaf scurfpea, blacksampson, dotted gayfeather, false-boneset, and aster, make up about 15 percent of the vegetation.

The major management concern on this site is maintaining the amount of the most productive species. After continued overgrazing, the amount of porcupinegrass, green needlegrass, and big bluestem decreases because livestock prefer these plants. Western wheatgrass, sideoats grama, and little bluestem initially increase in amount but then decrease. If overgrazing continues, these grasses are replaced by buffalograss and blue grama. The result is low forage production. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by rotation grazing or timely deferment of grazing.

Overflow Range site. The potential native vegetation on this site is mixed prairie grasses. Big bluestem, a tall warm-season grass, makes up about 45 percent of the vegetation. Warm-season, tall and mid grasses, such as switchgrass, indiangrass, little bluestem, and sideoats grama, make up about 20 percent. Green needlegrass and western wheatgrass, which are cool-season grasses, make up about 30 percent, and leadplant and sedges make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. The amount of big bluestem, switchgrass, green needlegrass, indiangrass, and little bluestem rapidly decreases after continuous grazing. As the amount of these plants decreases, the amount of western wheatgrass and sideoats grama initially increases. After continual overgrazing, however, Kentucky bluegrass, a short, cool-season grass, becomes the principal plant on the site. Low forage production is the result. The amount of the most productive grasses can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Sands range site. The potential native vegetation on this site is mixed tall and mid prairie grasses. Warm-season grasses, such as prairie sandreed, little bluestem, and sand bluestem, make up about 70 percent of the vegetation. Needleandthread, switchgrass, sand dropseed, and blue grama make up about 20 percent. Forbs and woody shrubs, such as leadplant, rose, and sandcherry, make up the remainder.

The main management concern on this site is maintaining the amount of the most productive grasses. After continuous grazing, the bluestems, prairie sandreed, and switchgrass are replaced by sand dropseed and blue grama. If overgrazing continues, the amount of green sagewort and sandbur increases and the surface is bare in spots. The bare areas are highly susceptible to wind erosion. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Sandy range site. The potential native vegetation on this site is mixed prairie grasses. Big bluestem, sand bluestem, and prairie sandreed, which are warm-season grasses, make up about 35 percent of the vegetation. Needleandthread, prairie junegrass, and western wheatgrass, which are cool-season grasses, make up about 35 percent. Sideoats grama, little bluestem, blue grama, and sedges make up about 25 percent. Forbs, such as heath aster, scurfpea, and sagewort, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continuous grazing, the amount of the bluestems decreases. The amount of prairie sandreed, needleandthread, and sideoats grama initially increases. After continuous overgrazing, these plants are replaced by blue grama and Kentucky bluegrass. Low forage production is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Shallow range site. The potential native vegetation on this site is dominantly little bluestem, sideoats grama, blue grama, and big bluestem. These warm-season grasses make up about 70 percent of the vegetation. Western wheatgrass and green needlegrass make up about 25 percent and sedges, forbs, and shrubs about 5 percent.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the amount of little bluestem and big bluestem decreases. The amount of western wheatgrass and sideoats grama initially increases after continuous grazing. It decreases, however, after continuous overgrazing. Under these conditions, the amount of blue grama and other less productive forage plants increases. Low forage production is the result. The amount of the most productive grasses can be maintained or increased by proper stocking rates and by deferred grazing or rotation grazing.

Shallow Clay range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 50 percent of the vegetation, as follows: little bluestem, 25 percent; sideoats grama, 10 percent; big bluestem, 5 percent; blue grama, 5 percent; and prairie sandreed, 5 percent.

Western wheatgrass and green needlegrass, which are cool-season grasses, make up about 40 percent of the vegetation. Sedges and forbs make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. Little bluestem, big bluestem, and green needlegrass rapidly decrease in amount after overgrazing. The amount of western wheatgrass and sideoats grama initially increases after continuous grazing. It decreases, however, after continuous overgrazing. As the amount of these grasses decreases, blue grama increases in abundance. Low forage production is the result. The amount of the most productive grasses can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Shallow Marsh range site. This site is ponded in spring and early in summer. The potential native vegetation is water-tolerant rushes, sedges, and forbs. Reedgrass and common spikesedge make up about 65 percent of the vegetation. American bulrush and prairie cordgrass make up about 25 percent. Forbs, such as smartweed and waterplantain, make up about 10 percent.

The major management concern on this site is maintaining the amount of the most productive plants. After continued overgrazing, reedgrass and slough sedge are replaced by other grasslike plants. The amount of the less palatable vegetation is increased. The amount of the most productive plants can be maintained by proper stocking rates and by deferred grazing.

Silty range site. The potential native vegetation on this site is cool-season grasses, which make up about 55 percent of the vegetation. Green needlegrass and western wheatgrass are the major cool-season grasses. Needleandthread and porcupinegrass are of lesser extent. Warm-season grasses, such as little bluestem, big bluestem, prairie dropseed, sideoats grama, and blue grama, make up about 35 percent of the vegetation. Forbs, such as sagewort, heath aster, and false-boneset, and shrubs, such as leadplant, rose, and western snowberry, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the bluestems, prairie dropseed, porcupinegrass, and green needlegrass decrease in abundance. The amount of western wheatgrass and needleandthread initially increases after continuous grazing. After continued overgrazing, short grasses, such as blue grama and Kentucky bluegrass, become dominant. Low forage production is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Western wheatgrass is the dominant cool-season grass. It makes up about 40 percent of the vegetation. Short, warm-season grasses, such as blue grama and buffalograss, make up about 40 percent. Inland saltgrass and sedges make up about 10 percent, and forbs, such as sagewort, heath aster, and broom snakeweed, make up the remainder.

The major management concern on this site is maintaining the amount of western wheatgrass. After continued overgrazing, this grass is replaced by blue grama, buffalograss, pricklypear, and saltgrass. If overgrazing continues, large bare areas are interspersed with the grasses, especially during dry periods. Weeds are common during wet periods. The amount of western wheatgrass can be increased or maintained by proper stocking rates and by timely deferment of grazing. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

Thin Upland range site. The potential native vegetation on this site is mixed prairie grasses. Cool-season grasses, such as green needlegrass, prairie junegrass, western wheatgrass, and needleandthread, make up about 45 percent of the vegetation. Warm-season grasses, such as little bluestem, sideoats grama, big bluestem, plains muhly, and blue grama, make up about 35 percent. Forbs, such as pasqueflower and blacksamson, and woody plants, such as leadplant and rose, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. The amount of little bluestem, big bluestem, and green needlegrass decreases after continuous grazing. The amount of western wheatgrass, sideoats grama, needleandthread, and plains muhly initially increases as that of the other grasses decreases. After continuous overgrazing, sedges and short grasses, such as blue grama, dominate the site. Low forage production is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Very Shallow range site. The potential native vegetation on this site is mid and short grasses. Needleandthread, the dominant mid grass, makes up about 30 percent of the vegetation. Short grasses, such as blue grama and hairy grama, make up about 30 percent. Sedges, such as threadleaf sedge, make up about 20 percent. Forbs, such as dotted gayfeather, blacksamson, and sagewort, and shrubs, such as leadplant and small soapweed, make up the remainder.

The main management concern on this site is maintaining the amount of the most productive grasses. After overgrazing, this site rapidly deteriorates to a stand of grama grasses, threadleaf sedge, and a few

unpalatable forbs. If overgrazing continues, the short grasses thin out and much of the site is bare and subject to erosion. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Native Woods, Windbreaks, and Environmental Plantings

Sheridan I. Dronen, forester, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 9,960 acres in Lyman County. They generally grow in the deeper drainageways on the breaks along Lake Francis Case and Lake Sharpe and on the flood plains along the White River. The soils that support trees are not classified as woodland soils. Nearly all of the wooded areas provide habitat for wildlife and protection for domestic animals.

Scattered individual plants or clumps of green ash, bur oak, hackberry, juniper, American plum, common chokecherry, skunkbush sumac, western snowberry, and wild rose are common on Opal and Sansarc soils on the north- and east-facing slopes of draws. Some of the deep draws on the breaks have a dense stand of eastern redcedar on the north- and east-facing slopes. Plains cottonwood, peachleaf willow, American elm, and boxelder commonly grow on Munjor and Inavale soils on the flood plains along the White River and on the narrow flood plains along the other major drainageways.

The early settlers valued the woody vegetation as a source of fuel and food. Currently, the native trees and shrubs are used chiefly for wildlife habitat.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Grazing is extremely damaging to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks. Grasses and weeds prevent maximum growth. Clean cultiviation and applications of herbicide help to control weeds. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks.

At the end of each map unit description under the heading "Detailed Soil Map Units," the soils are assigned to windbreak suitability groups. The groups are not numbered consecutively because the ones represented in the county do not include all of the groups in the statewide system. A windbreak suitability group is a distinctive group of soils based primarily on the suitability of the soils for locally adapted species, as is indicated by their growth and vigor. The relationship between the soils and the growth of trees and shrubs was ascertained during this survey. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the growth of trees and shrubs. Soil reaction, salt content, and a seasonal high water table also are important. Detailed information about each group is available in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and planting and caring for trees and shrubs can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning,

design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, prepared this section.

Wildlife resources in Lyman County are diverse. The most common species are those that use cropland and rangeland habitat. Woody habitat is sparse. It occurs naturally as scattered clumps in draws on the breaks along the Missouri River, in the Iona Hills, and on flood plains. Farm windbreaks provide a small amount of woody habitat. While not abundant, the scattered areas of shrubs and trees are critical sources of food and cover for many wildlife species. Management that protects and improves these wooded sites is needed. It is particularly effective if it is combined with proper management of the surrounding grassland.

The woody areas, especially those along streams, are very important to migrating songbirds. Along with well managed grassland, these areas provide habitat for such species as mule deer, sharp-tailed grouse, coyote, bobcat, and magpie.

Some species, such as antelope and prairie chicken, require larger, more open areas of grassland. They are common in the Fort Pierre National Grasslands, in the northwestern part of the county.

Many waterfowl species migrate through the county, but only mallard, gadwall, pintail, and blue-winged teal breed in the county. A small population of giant Canada geese has been established in the county. Natural wetlands are rare, but wetland habitat has been developed around many stock ponds and at the mouth of the White River and in other areas where streams flow into the Missouri River reservoirs.

Areas of cropland on the flood plains along the White River provide habitat for whitetail deer. Pheasants and gray partridge are common on the cropland throughout the county.

Fisheries are abundant in Lake Francis Case and Lake Sharpe. Other fishing waters include several small reservoirs, stock dams, and the White River. Medicine Creek and Bull Creek are major drainageways in the county, but they flow intermittently and are not significant fisheries.

All of Lyman County is suited to the development of rangeland wildlife habitat. The development of cropland, tame pasture or hayland, and woodland habitat is limited in much of the county because the supply of available moisture is low and the soils are erosive. In areas of the Lakoma-Okaton, Lakoma-Okaton-Reliance, Opal-Sansarc, and Sansarc-Opal soil associations, the slope is a major limitation affecting the development of habitat elements other than those on rangeland. Only the Millboro and Millboro-McClure associations have small areas of natural wetland habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing various kinds of habitat elements. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the habitat element is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the habitat element can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated habitat element. The element can be established, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the habitat element are very severe and that satisfactory results should not be expected. Establishing, improving, or maintaining the element is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are the thickness of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, sorghum, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are the thickness of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are crested wheatgrass, intermediate wheatgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are the thickness of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, goldenrod, beggarweed, wheatgrass, and grama grasses.

Planted hardwood trees and shrubs produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are the thickness of the root zone, available water capacity, and wetness. Examples of these plants are bur oak, cottonwood, chokecherry, green ash, plum, hawthorn, and dogwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American plum, Russian-olive, and Siberian crabapple.

Native coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are the thickness of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are the thickness of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are buffaloberry, plum, snowberry, and sagebrush.

Native hardwood trees produce fruit, buds, twigs, bark, and foliage. Soil properties are features that affect the growth of native hardwood trees are the thickness of the root zone, available water capacity, and wetness. Examples of these trees are ash, chokecherry, cottonwood, and bur oak.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are established by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are the depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Information concerning the habitat elements needed to maintain a specific wildlife species can be obtained from the local office of the Soil Conservation Service or from the South Dakota Department of Game, Fish and Parks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil

properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated

good, fair, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or

minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

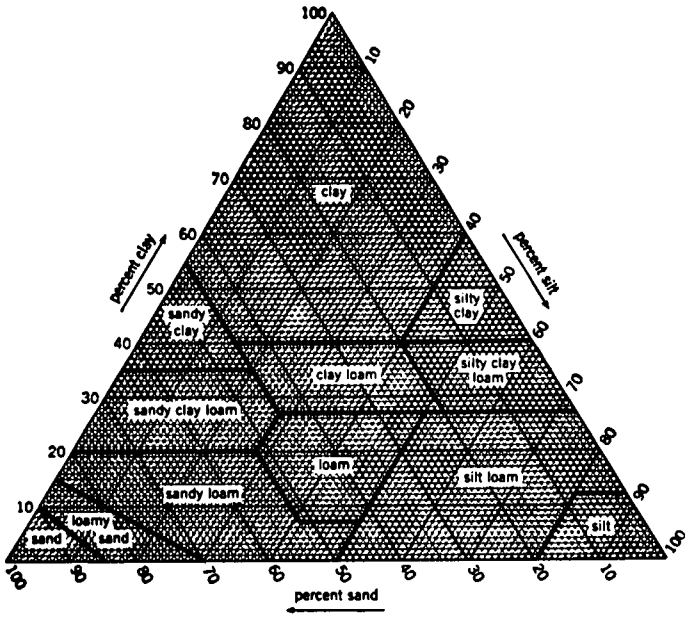

Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in

group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in this county range from 0.15 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after

rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the South Dakota Department of Transportation, Division of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); and Plasticity index—T 90 (AASHTO), D 424 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-silty, mixed, mesic Typic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Agar Series

The Agar series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Typical pedon of Agar silt loam, 3 to 6 percent slopes, 138 feet north and 2,125 feet east of the southwest corner of sec. 29, T. 106 N., R. 72 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bt1—8 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few tongues of silt loam, very dark brown (10YR 2/2) moist; neutral; clear wavy boundary.

Bt2—13 to 26 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk1—26 to 36 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—36 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—44 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few fine faint gray (5Y 5/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; common fine dark stains (iron and manganese oxides); strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 12 to 26 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. It is 4 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 to 3. It is silty clay loam or silt loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silty clay loam or silt loam. It is mildly alkaline or moderately alkaline.

Bigbend Series

The Bigbend series consists of deep, well drained soils formed in calcareous, loamy and silty alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Bigbend silt loam, 1,620 feet east and 955 feet south of the northwest corner of sec. 23, T. 103 N., R. 75 W.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure; slightly hard, very friable; few fine spots that are dark grayish brown (10YR 4/2) when moist; strong effervescence; moderately alkaline; clear smooth boundary.

C1—3 to 18 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; thin bedding planes; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—18 to 32 inches; pale brown (10YR 6/3) silt loam stratified with thin lenses of very fine sandy loam; brown (10YR 5/3) moist; massive; soft, very friable; few fine spots that are dark grayish brown (10YR 4/2) when moist; strong effervescence; moderately alkaline; gradual smooth boundary.

C3—32 to 60 inches; pale brown (10YR 6/3) silt loam stratified with thin layers of very fine sandy loam and fine sandy loam; brown (10YR 5/3) moist; soft, very friable; strong effervescence; moderately alkaline.

The soils generally contain free carbonates throughout, but some thin layers are not calcareous. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), chroma of 2 or 3. It dominantly is silt loam, but in some pedons it is very fine sandy loam, loam, or fine sandy loam. It is 3 to 8 inches thick. In pedons that have moist value of 3 or less, this horizon is less than 5 inches thick or is stratified. It is neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 2 or 3. It is stratified very fine sandy loam, silt loam, loam, fine sandy loam, loamy very fine sand, or silty clay loam. It is mildly alkaline or moderately alkaline throughout. In some pedons fine sand or gravelly sand is below a depth of 40 inches.

Boro Series

The Boro series consists of deep, well drained soils formed in clayey material on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is slow. Slopes range from 2 to 9 percent.

Typical pedon of Boro silty clay, in an area of Millboro-Boro silty clays, 2 to 6 percent slopes, 1,950 feet north and 100 feet west of the southeast corner of sec. 27, T. 101 N., R. 73 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—4 to 16 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure parting to moderate medium blocky and subangular blocky; very hard, firm, sticky and plastic; common tongues, very dark grayish brown (10YR 3/2) moist; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Bk1—16 to 26 inches; grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Bk2—26 to 36 inches; grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; moderate medium blocky structure; very hard, firm, sticky and plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—36 to 45 inches; grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and plastic; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—45 to 60 inches; grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and plastic; dark stains (iron and manganese oxides); violent effervescence; moderately alkaline.

The soils are mildly alkaline or moderately alkaline throughout. Free carbonates typically are at the surface, but in some pedons the surface layer is not calcareous.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is 2 to 5 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silty clay or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silty clay or clay. In some pedons shale is at a depth of 40 to 60 inches.

Bullcreek Series

The Bullcreek series consists of deep, moderately well drained soils formed in clayey alluvium in upland valleys. These soils are on foot slopes, alluvial fans, and terraces. When dry, they are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 6 percent.

Typical pedon of Bullcreek clay, 0 to 6 percent slopes, 2,000 feet west and 1,650 feet south of the northeast corner of sec. 8, T. 103 N., R. 73 W.

A—0 to 2 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; cracks about 1 inch wide; strong effervescence; moderately alkaline; clear smooth boundary.

Bw—2 to 8 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak medium and fine subangular blocky; very hard, very firm, sticky and plastic; cracks about 1 inch wide; few intersecting slickensides; strong effervescence; moderately alkaline; gradual smooth boundary.

Bkz—8 to 16 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse subangular blocky structure parting to weak medium and fine subangular blocky; very hard, very firm, sticky and plastic; cracks about 0.5 inch wide; few intersecting slickensides; common fine nests of gypsum and other salts; violent effervescence; moderately alkaline; clear smooth boundary.

Cz—16 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; common fine nests of gypsum and other salts; violent effervescence; mildly alkaline.

The soils generally contain free carbonates throughout, but some pedons do not have carbonates in the upper few inches. The depth to visible salts ranges from 7 to 16 inches. The surface generally is dispersed and crusted. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It dominantly is clay but in some pedons is silty clay. It is mildly alkaline or moderately alkaline. It is 1 to 4 inches thick. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It ranges from mildly alkaline to strongly alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. It has few to many nests of gypsum and other salts.

Carter Series

The Carter series consists of deep, moderately well drained soils formed in clayey material in swales and other areas on uplands. Permeability is very slow. Slopes range from 0 to 4 percent.

Typical pedon of Carter silt loam, 0 to 4 percent slopes, 195 feet east and 1,250 feet north of the southwest corner of sec. 9, T. 104 N., R. 73 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—4 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy

structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.
Bt1—7 to 10 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate coarse and medium subangular blocky; extremely hard, extremely firm, sticky and plastic; thin patchy grayish brown (10YR 5/2) caps on the top of columns; neutral; abrupt smooth boundary.
Bt2—10 to 13 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, sticky and plastic; mildly alkaline; clear smooth boundary.
Btk—13 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.
Bk—18 to 28 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, sticky and plastic; strong effervescence; moderately alkaline; gradual smooth boundary.
Cz—28 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, extremely firm, sticky and plastic; common fine nests of gypsum and other salts; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 10 to 22 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It ranges from slightly acid to mildly alkaline. It dominantly is silt loam but in some pedons is silty clay loam. It is 5 to 10 inches thick. Some pedons have an E horizon. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2. It ranges from neutral to moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is clay or silty clay. It has few to many accumulations of salt crystals. In some pedons it has few or common accumulations of carbonate. It is mildly alkaline or moderately alkaline.

Chantier Series

The Chantier series consists of shallow, well drained soils formed in clayey residuum on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 2 to 9 percent.

Typical pedon of Chantier clay, 2 to 9 percent slopes, 135 feet north and 2,000 feet west of the southeast corner of sec. 30, T. 106 N., R. 73 W.

A—0 to 2 inches; olive gray (5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; dark olive gray (5Y 3/2) films on faces of peds; extremely hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; abrupt smooth boundary.
Bw1—2 to 6 inches; olive gray (5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common slickensides; few very fine nests of salts and gypsum; slight effervescence; moderately alkaline; clear wavy boundary.
Bw2—6 to 11 inches; olive gray (5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common slickensides; few fine and medium nests of salts and gypsum; slight effervescence; moderately alkaline; clear wavy boundary.
Bz—11 to 15 inches; olive gray (5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common slickensides; many fine and medium nests of salts and gypsum; slight effervescence; moderately alkaline; clear smooth boundary.
C—15 to 19 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; 25 to 40 percent fragments of shale; few slickensides; common fine and medium nests of salts and gypsum; slight effervescence; moderately alkaline; clear smooth boundary.
Cr—19 to 60 inches; gray (5Y 6/1) soft shale, olive gray (5Y 5/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) iron stains; fine few nests of salts and gypsum in seams; slight effervescence; moderately alkaline.

The depth to shale ranges from 10 to 20 inches. Typically, the soils contain free carbonates throughout, but some pedons do not have free carbonates in the upper 3 inches.

The A horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. It is 1 to 3 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. The Bz horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It has common or many fine nests of salts and gypsum. The B horizon is mildly alkaline to strongly

alkaline throughout. The electrical conductivity ranges from 4 to 16 millimhos per centimeter. The C horizon has hue of 5Y or 2.5Y, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3. The Cr horizon has common or many yellowish brown stains along cracks in the shale. It is mildly alkaline to strongly alkaline.

Fairlo Series

The Fairlo series consists of deep, well drained soils formed in a mantle of loess over clayey material. These soils are on uplands. Permeability is moderate in the subsoil and slow in the underlying material. Slopes range from 0 to 6 percent.

Typical pedon of Fairlo silt loam, 3 to 6 percent slopes, 1,175 feet north and 100 feet west of the southeast corner of sec. 9, T. 107 N., R. 75 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A2—4 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable; many very fine and fine roots; slightly acid; clear wavy boundary.

Bt1—9 to 14 inches; dark brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak coarse and medium subangular blocky; hard, friable; slightly sticky and slightly plastic; common fine and very fine roots; shiny films on faces of peds; neutral; gradual smooth boundary.

Bt2—14 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable; common fine and very fine roots; slightly sticky and slightly plastic; shiny films on faces of peds; mildly alkaline; abrupt smooth boundary.

Bk1—18 to 24 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak moderate subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—24 to 29 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2Bk3—29 to 55 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; many medium and coarse accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2Bk4—55 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, friable, slightly sticky and plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. It is 6 to 10 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 to 4. It is silty clay loam or silt loam. It is slightly acid to mildly alkaline. The Bk horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay loam or silt loam. It is mildly alkaline or moderately alkaline. The 2Bk horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay loam, silty clay, or clay. It is mildly alkaline or moderately alkaline. Some pedons have shale below a depth of 40 inches.

Hilmoe Series

The Hilmoe series consists of deep, moderately well drained soils formed in a mantle of clayey alluvium over loamy and silty alluvium. These soils are on the flood plains along the White River. Permeability is slow in the upper part of the profile and moderate in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Hilmoe silty clay, 1,600 feet west and 150 feet north of the southeast corner of sec. 5, T. 103 N., R. 74 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—5 to 11 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C1—11 to 25 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky and weak medium granular structure; hard, firm, sticky and plastic; thin light brownish gray (2.5Y 6/2) layers; strong effervescence; mildly alkaline; clear smooth boundary.

2C2—25 to 60 inches; light brownish gray (2.5Y 6/2) loam and silt loam stratified with thin layers of very fine sandy loam, loamy fine sand, and clay loam; dark grayish brown (2.5Y 4/2) moist; common fine distinct yellowish brown (10YR 5/6) moist and dark yellowish brown (10YR 3/6) mottles; massive; slightly hard, very friable; strong effervescence; mildly alkaline.

Free carbonates are at or near the surface. The soils are mildly alkaline or moderately alkaline throughout. The clayey mantle ranges from 18 to 30 inches in thickness.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay but in some pedons is silty clay loam. It is 5 to 12 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. It is stratified silty clay, clay, or silty clay loam. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. In some pedons the loamy material is below a depth of 40 inches.

Hoven Series

The Hoven series consists of deep, poorly drained soils formed in clayey alluvium in depressions on uplands. Permeability is very slow. Slopes are less than 1 percent.

Typical pedon of Hoven silt loam, 1,750 feet north and 78 feet west of the southeast corner of sec. 14, T. 105 N., R. 73 W.

E—0 to 2 inches; gray (10YR 5/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

Bt1—2 to 5 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium and fine columnar structure parting to moderate coarse and medium subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; thin gray (10YR 5/1) coatings on the top of columns; neutral; clear smooth boundary.

Bt2—5 to 10 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, very firm, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

Btk—10 to 16 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate coarse and medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

Bkz—16 to 30 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; few nests of gypsum and other salts; mildly alkaline; gradual smooth boundary.

C—30 to 60 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; few nests of gypsum and other salts; mildly alkaline.

Some pedons have an A horizon, which is 1 to 3 inches thick. The E horizon has hue of 10YR, value of 5 to 7 (2 to 4 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is 1 to 4 inches thick. It is medium acid to neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay, clay, or silty clay loam. It is slightly acid to moderately alkaline. Some pedons do not have a Bk horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 to 3. It is silty clay, clay, or silty clay loam. It is mildly alkaline to strongly alkaline. In some pedons shale is at a depth of 40 to 60 inches.

Hurley Series

The Hurley series consists of deep, moderately well drained soils formed in clayey material on uplands. Permeability is very slow. Slopes range from 0 to 6 percent.

These soils are taxadjuncts to the Hurley series because they are underlain by shale at a greater depth than is definitive for the series.

Typical pedon of Hurley silt loam, 0 to 6 percent slopes, 2,270 feet west and 120 feet south of the northeast corner of sec. 33, T. 106 N., R. 73 W.

E—0 to 2 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak very thin platy structure parting to weak fine granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bt1—2 to 6 inches; dark gray (10YR 4/1) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium columnar structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; gray (10YR 6/1) coatings on the top of columns; mildly alkaline; clear smooth boundary.

Bt2—6 to 9 inches; dark gray (5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, sticky and plastic; few fine nests of gypsum and other salts; strong effervescence; mildly alkaline; gradual smooth boundary.

Bkz1—9 to 14 inches; dark gray (5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine nests of gypsum

and other salts; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkz2—14 to 24 inches; olive gray (5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine accumulations of carbonate; common fine nests of gypsum and other salts; violent effervescence; mildly alkaline; gradual wavy boundary.

Bkz3—24 to 33 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine accumulations of carbonate; many fine nests of gypsum and other salts; violent effervescence; mildly alkaline; gradual wavy boundary.

Cz—33 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; many fine and medium nests of gypsum and other salts; violent effervescence; mildly alkaline.

The E horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is slightly acid or neutral. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is clay or silty clay. It is mildly alkaline or moderately alkaline. The Bk horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It is clay or silty clay. It has few to many accumulations of carbonate and few to many nests of gypsum and other salts. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It is mildly alkaline to strongly alkaline.

Inavale Series

The Inavale series consists of deep, somewhat excessively drained soils formed in sandy alluvium on the flood plains along the White River. Permeability is rapid. Slopes range from 0 to 3 percent.

Typical pedon of Inavale loamy fine sand, 1,900 feet south and 200 feet east of the northwest corner of sec. 9, T. 103 N., R. 73 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—4 to 8 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; strong effervescence; moderately alkaline; clear smooth boundary.

C—8 to 60 inches; light brownish gray (10YR 6/2) fine sand stratified with thin layers of loamy fine sand; dark grayish brown (10YR 4/2) moist; single grain; loose; strong effervescence; moderately alkaline.

The soils typically are calcareous throughout, but in some pedons they are not calcareous in the upper few inches. They are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It dominantly is loamy fine sand but in some pedons is fine sandy loam. It is 4 to 8 inches thick. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is stratified loamy fine sand, loamy sand, fine sand, or sand.

Kolls Series

The Kolls series consists of deep, poorly drained and very poorly drained soils formed in clayey alluvium in depressions on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes are less than 1 percent.

Typical pedon of Kolls silty clay, 2,300 feet north and 580 feet east of the southwest corner of sec. 17, T. 104 N., R. 79 W.

A—0 to 3 inches; dark gray (N 4/0) silty clay, very dark gray (N 3/0) moist; weak medium and fine subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few cracks about 1 inch wide; slight effervescence; mildly alkaline; clear smooth boundary.

Bg1—3 to 15 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; extremely hard, extremely firm, very sticky and very plastic; few cracks 0.5 to 1.0 inch wide; strong effervescence; mildly alkaline; clear smooth boundary.

Bg2—15 to 29 inches; gray (N 5/0) clay, dark gray (N 4/0) moist; moderate coarse and medium blocky structure; extremely hard, extremely firm, very sticky and very plastic; few cracks 0.5 inch wide; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg1—29 to 48 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse and medium blocky structure; extremely hard, extremely firm, very sticky and very plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—48 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; strong effervescence; moderately alkaline.

The mollic epipedon typically is less than 18 inches thick, but it extends to a depth of 30 inches in some pedons. Carbonates are at or near the surface. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 (2 or 3 moist) and chroma of 0 or 1. It dominantly is silty clay but in some pedons is clay. It is 2 to 5 inches thick. The Bg horizon has hue of 10YR or is neutral in hue. It has value of 4 or 5 (2 to 4 moist) and chroma of 0 or 1. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It has few to many fine accumulations of carbonate and gypsum in some pedons.

Lakoma Series

The Lakoma series consists of moderately deep, well drained soils formed in clayey residuum on uplands. Permeability is slow. Slopes range from 2 to 30 percent.

Typical pedon of Lakoma silty clay, in an area of Lakoma-Okaton silty clays, 6 to 15 percent slopes, 135 feet north and 2,195 feet west of the southeast corner of sec. 27, T. 101 N., R. 73 W.

A—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; clear smooth boundary.

Bw1—5 to 10 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; clear smooth boundary.

Bw2—10 to 17 inches; grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; gradual wavy boundary.

C—17 to 25 inches; light olive brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; about 30 percent fragments of shale; violent effervescence; mildly alkaline; clear wavy boundary.

Cr1—25 to 32 inches; pale yellow (2.5Y 7/4) shale, light olive brown (2.5Y 5/4) moist; many medium gypsum crystals in cracks and seams; violent effervescence; mildly alkaline; abrupt wavy boundary.

Cr2—32 to 60 inches; pale yellow (2.5Y 7/4) shale, light olive brown (2.5Y 5/4) moist; common medium and fine gypsum crystals in cracks and seams; violent effervescence; mildly alkaline.

The depth to shale ranges from 20 to 40 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It dominantly is silty clay but in some pedons is clay. It is 4 to 6 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is silty clay or clay. Some pedons have a Bk horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay or silty clay. The content of shale fragments in this horizon ranges from 10 to 60 percent.

Lowry Series

The Lowry series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Typical pedon of Lowry silt loam, 0 to 2 percent slopes, 2,490 feet north and 310 feet east of the southwest corner of sec. 26, T. 105 N., R. 71 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

Bw—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

Bk1—13 to 19 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine accumulations of carbonate; slight effervescence; moderately alkaline; gradual smooth boundary.

Bk2—19 to 26 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk3—26 to 36 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 8 to 18 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches. Some pedons have a buried A horizon below a depth of 30 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It dominantly is silt loam but in some pedons is very fine sandy loam. It is neutral or mildly alkaline. It is 4 to 10 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silt loam or very fine sandy loam. It ranges from neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silt loam, very fine sandy loam, or loam. It is mildly alkaline or moderately alkaline.

McClure Series

The McClure series consists of deep, well drained soils formed in a thin mantle of loess over clayey material. These soils are on uplands. Permeability is moderately slow in the upper part of the profile and slow in the underlying material. Slopes range from 0 to 9 percent.

Typical pedon of McClure silt loam, 3 to 6 percent slopes, 1,030 feet east and 190 feet south of the northwest corner of sec. 5, T. 108 N., R. 77 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; moderate medium and fine subangular blocky structure parting to weak fine granular; soft, very friable; neutral; abrupt smooth boundary.

A2—3 to 5 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to weak medium and fine granular; slightly hard, friable; neutral; clear smooth boundary.

Bt1—5 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bt2—11 to 20 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

2Bk1—20 to 28 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, very firm, sticky and plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2Bk2—28 to 40 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure; very hard, very firm, sticky and plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—40 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 16 to 28 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches. The depth to contrasting clayey material ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is slightly acid or neutral. It is 5 to 10 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. It is neutral or mildly alkaline. Some pedons have a Bk horizon. The 2Bk horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is silty clay or clay. It is mildly alkaline or moderately alkaline. The 2C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. In some pedons shale is at a depth of 40 to 60 inches.

Millboro Series

The Millboro series consists of deep, well drained soils formed in clayey material on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is slow. Slopes range from 0 to 9 percent.

Typical pedon of Millboro silty clay, 3 to 6 percent slopes, 2,375 feet north and 750 feet west of the southeast corner of sec. 8, T. 105 N., R. 77 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; abrupt smooth boundary.

Bt—5 to 13 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak coarse and medium subangular blocky; very hard, very firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

Btk—13 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard,

very firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Bk1—18 to 41 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate coarse subangular blocky; very hard, very firm, sticky and plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—41 to 53 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few intersecting slickensides; common fine accumulations of carbonate; few fine nests of gypsum and other salts; violent effervescence; moderately alkaline; gradual wavy boundary.

C—53 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate; few fine nests of gypsum and other salts; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 7 to 20 inches in areas of range, but in cultivated areas free carbonates are at the surface. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or silty clay loam. It is neutral or mildly alkaline. It is 4 to 10 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It is clay or silty clay. It is neutral or mildly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay or clay. It is mildly alkaline or moderately alkaline. In some pedons shale is at a depth of 40 to 60 inches.

Mobridge Series

The Mobridge series consists of deep, moderately well drained soils formed in silty alluvium in swales on uplands. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Mobridge silt loam, 96 feet east and 1,650 feet north of the southwest corner of sec. 35, T. 106 N., R. 72 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (l0YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear wavy boundary.

Bt1—12 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bt2—23 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable, sticky and plastic; neutral; clear wavy boundary.

Bk—30 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Ab—34 to 38 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear smooth boundary.

C1—38 to 52 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—52 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable; slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 18 to 32 inches. The thickness of the mollic epipedon ranges from 20 to 34 inches.

The A horizon has hue of 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is slightly acid or neutral. It is 7 to 14 inches thick. The Bt horizon has hue of 10YR, value of 3 or 4 (2 to 4 moist), and chroma of 1 or 2. It is slightly acid to mildly alkaline. The content of clay in this horizon ranges from 28 to 35 percent. Some pedons do not have a buried A horizon.

Munjor Series

The Munjor series consists of deep, well drained soils formed in calcareous, loamy and sandy alluvium on the flood plains along the White River. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Typical pedon of Munjor fine sandy loam, 1,300 feet north and 350 feet east of the southwest corner of sec. 25, T. 103 N., R. 78 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse and medium subangular blocky and weak medium and fine granular structure; thin strata of darker and lighter colored material throughout; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—6 to 36 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; thin strata of finer textured and coarser textured material throughout; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

2C2—36 to 60 inches; light gray (10YR 7/2) stratified loamy sand, fine sand, and sand, grayish brown (10YR 5/2) moist; single grain; loose; strong effervescence; moderately alkaline.

The depth to free carbonates is less than 10 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. If the upper part of this horizon has value darker than 5.5 when dry and 3.5 when moist, it is less than 5 inches thick. The A horizon dominantly is fine sandy loam, but in some pedons it is sandy loam, loamy fine sand, or loam. It is 4 to 10 inches thick. Some pedons have an AC horizon. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is fine sandy loam, sandy loam, loamy very fine sand, or loam and has thin strata of coarser or finer textured material. The 2C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4. It is stratified loamy fine sand, loamy sand, fine sand, or sand. In some pedons the content of gravel in this horizon is 1 to 3 percent. Some pedons do not have a 2C horizon.

Okaton Series

The Okaton series consists of shallow, well drained soils formed in clayey residuum on uplands. Permeability is slow. Slopes range from 6 to 50 percent.

Typical pedon of Okaton silty clay, in an area of Lakoma-Okaton silty clays, 6 to 15 percent slopes, 1,760 feet west and 200 feet north of the southeast corner of sec. 24, T. 101 N., R. 72 W.

A—0 to 3 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; hard, friable, sticky and plastic; common fine and very fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

AC—3 to 7 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium and fine subangular blocky structure; hard, friable, sticky and plastic; 10 to 20 percent fragments of shale; common very fine roots; violent effervescence; mildly alkaline; clear wavy boundary.

C—7 to 12 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; few fine iron stains, yellowish brown (10YR 5/8) moist; 30 to 50 percent fragments of shale; few very fine roots; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr1—12 to 17 inches; light brownish gray (2.5Y 6/2) shale, dark grayish brown (2.5Y 4/2) moist; few fine iron stains in seams and cracks, brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) moist; few very fine roots between shale plates; strong effervescence; mildly alkaline; clear smooth boundary.

Cr2—17 to 60 inches; light brownish gray (2.5Y 6/2) shale, dark grayish brown (2.5Y 4/2) moist; common fine and medium iron stains in seams and cracks, brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) moist; common fine and medium nests of gypsum and other salts in seams; strong effervescence; mildly alkaline.

The depth to shale ranges from 8 to 20 inches. The soils are mildly alkaline or moderately alkaline throughout. Large rock fragments cover 3 to 15 percent of the surface in some areas.

The A horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silty clay or clay. It is 1 to 4 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. In some pedons the Cr horizon has many fine to coarse nests of gypsum in the seams in the bedrock.

Onita Series

The Onita series consists of deep, moderately well drained soils formed in local alluvium in swales on uplands. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Onita silt loam, 80 feet east and 2,000 feet north of the southwest corner of sec. 12, T. 105 N., R. 73 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A—6 to 20 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

Bt—20 to 36 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; neutral; gradual smooth boundary.

Bk1—36 to 46 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Bk2—46 to 60 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates ranges from 23 to 40 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam or loam. It ranges from medium acid to neutral. It is 8 to 20 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 3. It is silty clay loam or silty clay. It is slightly acid or neutral. The Bk horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is silt loam or silty clay loam. It ranges from neutral to moderately alkaline. Some pedons have a C horizon.

Opal Series

The Opal series consists of moderately deep, well drained soils formed in clayey residuum on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 25 percent.

Typical pedon of Opal clay, 3 to 6 percent slopes, 2,260 feet east and 1,100 feet north of the southwest corner of sec. 14, T. 105 N., R. 76 W.

A—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium and fine subangular blocky structure parting to moderate medium and fine granular; hard, firm, sticky and plastic; many fine roots; mildly alkaline; clear wavy boundary.

Bw—5 to 14 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine blocky structure; extremely hard, very firm, sticky and plastic; few intersecting slickensides; cracks about 1 inch wide; common fine roots; few fine accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

Bk1—14 to 21 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (10YR 4/2) moist; weak coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; few intersecting slickensides; cracks about 1 inch wide; few very dark gray (N 3/0) tongues; few fine roots; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk2—21 to 27 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine blocky structure; extremely hard, very firm, sticky and plastic; few intersecting slickensides; few very fine roots; few fragments of shale in lower part; cracks 0.5 to 1.0 inch wide; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—27 to 32 inches; grayish brown (2.5Y 5/2) clay, dark gray (5Y 4/1) and olive gray (5Y 4/2) moist; massive; hard, very firm, sticky and plastic; 25 to 35 percent fragments of shale; many fine salt and gypsum crystals; few fine roots; neutral; clear wavy boundary.

Cr—32 to 60 inches; gray (5Y 5/1) shale, very dark gray (5Y 3/1) moist; many stains (iron and manganese oxides) in seams; neutral.

The depth to shale ranges from 20 to 40 inches. The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It typically is clay but in some pedons is silty clay. It is neutral or mildly alkaline. It is 4 to 8 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is neutral to moderately alkaline. In some pedons the lower part of the B horizon does not have accumulations of carbonate. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is neutral to moderately alkaline. The Cr horizon is slightly acid to moderately alkaline.

Orton Series

The Orton series consists of well drained soils formed in loamy sediments on terraces. These soils are moderately deep over gravelly material. Permeability is moderately rapid in the upper part of the profile and rapid in the gravelly underlying material. Slopes range from 2 to 7 percent.

Typical pedon of Orton loam, 2 to 7 percent slopes, 2,310 feet south and 160 feet east of the northwest corner of sec. 15, T. 108 N., R. 73 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.
Bw1—5 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.
Bw2—11 to 15 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; slight effervescence; mildly alkaline; gradual wavy boundary.
Bk1—15 to 25 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; few fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.
Bk2—25 to 30 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.
2C—30 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose; strong effervescence; moderately alkaline.

The depth to gravelly material ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches.

The A and Bw horizons are loam or fine sandy loam. They are neutral or mildly alkaline. The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is 3 to 5 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. Some pedons have a C horizon. The 2C horizon is multicolored, mildly alkaline or moderately alkaline gravelly material. The content of gravel in this horizon is 20 to 50 percent.

Orton Variant

The Orton Variant consists of deep, well drained soils formed in loamy material on terraces. Permeability is moderately rapid. Slopes range from 0 to 6 percent.

Typical pedon of Orton Variant loam, in an area of Orton Variant-Valentine complex, 2 to 6 percent slopes, 1,420 feet west and 150 feet south of the northeast corner of sec. 7, T. 108 N., R. 73 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.
A2—5 to 8 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to weak medium and fine subangular blocky; soft, very friable; mildly alkaline; clear smooth boundary.
Bw—8 to 16 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.
Bk1—16 to 32 inches; grayish brown (10YR 5/2) stratified sandy loam, loamy sand, and sand, dark grayish brown (10YR 4/2) moist; weak fine prismatic structure parting to weak medium subangular blocky; soft, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.
Bk2—32 to 44 inches; grayish brown (10YR 5/2) stratified sandy loam and loamy sand, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; few fine pebbles; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.
2C—44 to 60 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The depth to free carbonates is 5 to 10 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to the 2C horizon ranges from 40 to 60 inches. The control section is fine sandy loam, sandy loam, or loam in which the content of clay is less than 18 percent.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. It is loam, fine sandy loam, or sandy loam. It is neutral or mildly alkaline. It is 3 to 8 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is fine sandy loam or sandy loam. It is mildly alkaline or moderately alkaline. In some pedons the lower part of the Bk horizon is gravelly loamy sand or gravelly sand. The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is silt loam, very fine sandy loam, or loam.

Promise Series

The Promise series consists of deep, well drained soils formed in clayey material on foot slopes and uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Promise clay, 3 to 6 percent slopes, 2,490 feet south and 165 feet east of the northwest corner of sec. 26, T. 107 N., R. 79 W.

Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium and fine granular structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—7 to 21 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse and medium subangular blocky structure; very hard, very firm, sticky and plastic; cracks 0.5 to 1.0 inch wide; few intersecting slickensides; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk1—21 to 27 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; cracks 0.5 to 1.0 inch wide; few intersecting slickensides; few tongues, very dark grayish brown (2.5Y 3/2) moist; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—27 to 35 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few intersecting slickensides; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Cy—35 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; common fine nests of gypsum; violent effervescence; mildly alkaline.

The depth to free carbonates is 0 to 8 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay. It is slightly acid to mildly alkaline. It is 4 to 10 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. Some pedons do not have a Bk horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is clay or silty clay. In some pedons shale is at a depth of 40 to 60 inches.

Ree Series

The Ree series consists of deep, well drained soils formed in loamy material on terraces. Permeability is moderate. Slopes range from 2 to 9 percent.

Typical pedon of Ree silt loam, 2 to 6 percent slopes, 2,450 feet north and 600 feet west of the southeast corner of sec. 15, T. 103 N., R. 75 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure parting to weak medium and fine granular; slightly hard, friable; neutral; clear smooth boundary.

A2—4 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

Bt—10 to 18 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine prismatic structure parting to weak medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bk1—18 to 27 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

Bk2—27 to 37 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C—37 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 12 to 24 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. It dominantly is silt loam but in some pedons is loam. It is 4 to 10 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 to 4. It is silty clay loam, clay loam, or sandy clay loam. It is neutral or mildly alkaline. Some pedons have a Btk horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is sandy loam, loam, silt loam, or clay loam. It is mildly alkaline or moderately alkaline. In some pedons gravelly sand is at a depth of 40 to 60 inches.

Reliance Series

The Reliance series consists of deep, well drained soils formed in loess on uplands. Permeability is moderately slow. Slopes range from 0 to 9 percent.

Typical pedon of Reliance silty clay loam, 3 to 6 percent slopes, 2,540 feet south and 70 feet east of the northwest corner of sec. 32, T. 101 N., R. 72 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark gray (10YR 3/1) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—7 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

Bt1—11 to 17 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, firm, sticky and plastic; few tongues of dark grayish brown (10YR 4/2) silty clay loam; shiny films on faces of peds; neutral; clear smooth boundary.

Bt2—17 to 27 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate coarse and medium subangular blocky; hard, firm, sticky and plastic; few tongues of dark grayish brown (10YR 4/2) silty clay loam; shiny films on faces of peds; neutral; gradual smooth boundary.

Bk—27 to 45 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C—45 to 60 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 14 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 18 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay loam but in some pedons is silt loam. It is slightly acid or neutral. It is 6 to 14 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 to 4. It is slightly acid to mildly alkaline. It is silty clay loam or silty clay. The content of clay in this horizon ranges from 35 to 45 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline. In some pedons clay, shale, sand and gravel, or weakly cemented sandstone is at a depth of 40 to 60 inches.

Sansarc Series

The Sansarc series consists of shallow, well drained soils formed in clayey residuum on uplands. Permeability is slow. Slopes range from 6 to 40 percent.

Typical pedon of Sansarc clay, in an area of Sansarc-Opal clays, 9 to 40 percent slopes, 1,350 feet east and 55 feet north of the southwest corner of sec. 10, T. 105 N., R. 72 W.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky and weak fine granular structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

AC—3 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure parting to weak coarse and medium granular; very hard, firm, sticky and plastic; about 20 percent fragments of shale; slight effervescence; mildly alkaline; gradual wavy boundary.

C—8 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very firm, sticky and plastic; about 55 percent fragments of shale; few fine yellowish brown (10YR 5/6) stains (iron and manganese oxides); slight effervescence; mildly alkaline; gradual wavy boundary.

Cr—15 to 60 inches; light olive gray (5Y 6/2) shale, olive gray (5Y 4/2) moist; few fine and medium yellowish brown (10YR 5/6) stains (iron and manganese oxides); few fine nests of gypsum and other salts in the upper part; slight effervescence; mildly alkaline.

The depth to shale ranges from 8 to 20 inches. The shale is soft and can be easily dug with a spade. Generally, free carbonates are at the surface.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. It is 2 to 4 inches thick. It is neutral to moderately alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. The content of shale fragments in this horizon is as much as 50 percent or more. The Cr horizon is shale that has a wide range of color. It contains varying amounts of carbonates, gypsum, and other salts. In some pedons it does not have free carbonates. It ranges from medium acid to moderately alkaline.

Schamber Series

The Schamber series consists of excessively drained soils that are very shallow over gravelly material. These soils formed in sandy and gravelly material on terrace scarps. Permeability is rapid. Slopes range from 6 to 40 percent.

These soils are taxajuncts to the Schamber series because they receive somewhat more precipitation than is definitive for the series.

Typical pedon of Schamber loam, 6 to 40 percent slopes, 2,050 feet east and 175 feet south of the northwest corner of sec. 28, T. 106 N., R. 71 W.

A—0 to 5 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear wavy boundary.

C1—5 to 18 inches; multicolored gravelly loamy sand; single grain; loose; about 30 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—18 to 60 inches; multicolored very gravelly loamy sand; single grain; loose; about 40 percent gravel; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. It dominantly is loam but in some pedons is gravelly loam or sandy loam. It is slightly acid to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is gravelly sand, gravelly loamy sand, or very gravelly loamy sand. It is mildly alkaline or moderately alkaline. Some pedons are noncalcareous throughout.

Sully Series

The Sully series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

Typical pedon of Sully silt loam, in an area of Lowry-Sully silt loams, 9 to 25 percent slopes, 25 feet east and 1,580 feet south of the northwest corner of sec. 35, T. 105 N., R. 71 W.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

AC—4 to 19 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—19 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; massive; soft, very friable; common fine accumulations of carbonate; strong effervescence, moderately alkaline.

The depth to free carbonates is 0 to 5 inches. The A horizon has hue of 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It dominantly is silt loam but in some pedons is very fine sandy loam. It is neutral or mildly alkaline. It is 2 to 5 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. It is silt loam or very fine sandy loam. Sand and gravel, clay, or shale is below a depth of 40 inches in some pedons.

Valentine Series

The Valentine series consists of deep, excessively drained soils formed in sandy eolian material on terraces. Permeability is rapid. Slopes range from 2 to 25 percent.

Typical pedon of Valentine fine sand, 6 to 25 percent slopes, 2,450 feet west and 100 feet south of the northeast corner of sec. 7, T. 108 N., R. 73 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure breaking to single grain; loose; neutral; clear smooth boundary.

AC—4 to 14 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure breaking to single grain; loose; neutral; gradual smooth boundary.

C—14 to 60 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral.

The soils are slightly acid or neutral throughout. The A horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2. It is 3 to 9 inches thick. The C horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Wendte Series

The Wendte series consists of deep, moderately well drained soils formed in clayey alluvium on narrow flood plains. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend into the underlying material. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Wendte silty clay, channeled, 250 feet north and 500 feet west of the southeast corner of sec. 12, T. 105 N., R. 76 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium subangular structure parting to weak fine granular; hard, firm, sticky and plastic; very thin

strata 1/8 to 1/4 inch thick; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—5 to 19 inches; grayish brown (2.5Y 5/2) silty clay stratified with thin layers of clay loam and silty clay loam; very dark grayish brown (2.5Y 3/2) moist; few fine distinct dark yellowish brown (10YR 4/6) mottles; weak medium and fine subangular blocky and weak thin platy structure; hard, firm, sticky and plastic; few very thin light gray (2.5Y 7/2) layers; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C2—19 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) moist; few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; hard, firm, sticky and plastic; few very thin light brownish gray (2.5Y 6/2) layers; strong effervescence; mildly alkaline; clear smooth boundary.

C3—24 to 60 inches; grayish brown (2.5Y 5/2) stratified silty clay and silty clay loam, dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) moist; massive; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

Typically, the soils are calcareous throughout, but they have thin strata of noncalcareous material in some pedons. They are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay but in some pedons is clay or silty clay loam. It is 5 to 9 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 6 moist), and chroma of 1 to 4. It is dominantly stratified clay, silty clay, silty clay loam, or clay loam, but it has thin layers of coarser textured material in some pedons. It has few fine or medium crystals of gypsum in some pedons.

Witten Series

The Witten series consists of deep, moderately well drained soils formed in clayey alluvium in swales on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is slow. Slopes range from 0 to 3 percent.

Typical pedon of Witten silty clay, 486 feet south and 1,800 feet west of the northeast corner of sec. 33, T. 105 N., R. 75 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; sticky and plastic; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—5 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

Bt1—8 to 18 inches; dark grayish brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; weak medium and fine prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

Bt2—18 to 24 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; common medium tongues, very dark brown (10YR 2/2) moist; violent effervescence; mildly alkaline; clear smooth boundary.

BC—24 to 34 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; common fine tongues, very dark brown (10YR 2/2) moist; violent effervescence; moderately alkaline; clear smooth boundary.

Cz—34 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard; firm, sticky and plastic; common fine nests of gypsum and other salts; violent effervescence; mildly alkaline.

Free carbonates typically are at the surface, but some pedons are leached to a depth of 12 inches. The thickness of the mollic epipedon ranges from 20 to 30 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay but in some pedons is clay. It is neutral or mildly alkaline. It is 8 to 14 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is clay or silty clay. It is neutral or mildly alkaline. Some pedons have a Bk horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is clay or silty clay. It is mildly alkaline or moderately alkaline. It has few to many nests of gypsum and other salt crystals.

Formation of the Soils

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are modified by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Lyman County.

Climate

Climate directly influences the rate of chemical and physical weathering. Lyman County has a continential climate marked by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. The climate generally is uniform throughout the county. Thus, it is not a factor in differentiating the soils within the county. Additional climatic data are given under the heading "General Nature of the County."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, and fungi have important effects on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Lyman County the prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many of the soils has a moderate or high content of organic matter. Onita and Mobridge soils are examples.

Earthworms, insects, and burrowing animals help to keep the soils open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

Parent material is the unconsolidated organic and mineral material in which soil forms. It determines many of the chemical and physical characteristics of the soil, such as color, texture, reaction, and consistence. The rate of soil formation is more rapid in the more friable, loamy and silty parent material than in other kinds of parent material. Also, more changes take place, and the horizons are more distinct.

Most of the soils in Lyman County formed in material weathered from the underlying geologic formations. The rest formed in material transported and redeposited by wind and water.

The bedrock in Lyman County dominantly is marine shale of the Pierre Formation. It was deposited during the Late Cretaceous Period. It is dark gray to light gray and has beds of bentonite and seams of limestone, iron, and manganese concretions. Lakoma, Okaton, Opal, and Sansarc soils formed in material weathered from the Pierre Formation.

Loess and sandy eolian material are two kinds of wind-deposited parent material in the county. Loess mantles the uplands, mainly those in areas of the Agar-McClure and Lowry soil associations, which are described under the heading "General Soil Map Units." Agar, Fairlo, Lowry, and Reliance formed in this silty loess. Valentine soils are examples of soils that formed in sandy eolian material.

The alluvium in Lyman County is recently deposited clayey to sandy material on the flood plains along drainageways and in upland depressions. It also is deposited on nearly level to steep terraces that are not identified with the present drainage system. Bigbend, Hilmoe, Inavale, Munjor, and Wendte soils formed in alluvium on flood plains. Kolls, Mobridge, Onita, and Witten soils formed partly or entirely in local alluvium washed in from the more sloping adjacent soils in the uplands. Ree and Schamber are examples of soils that formed in alluvium on terraces.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Sansarc soils, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and a low content of organic matter. Runoff is slower on Agar, Lowry, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than the Sansarc soils. Also, the horizons in which organic matter accumulates are thicker.

Kolls soils are in depressions where water ponds. They have the colors characteristic of poorly drained soils. Mobridge soils are in swales and receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in the slightly higher adjacent Agar soils.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that have formed. The degree of profile development reflects the age of a soil. The oldest soils are on parts of the landscape that have been stable for the longest time. In Lyman County they are the Reliance and Ree soils. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Sansarc soils are an example of young soils that are subject to natural erosion. Bigbend and Wendte soils are examples of young alluvial soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in rows that follow the contour.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of

the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are—

	Inches
Deep	more than 40
Moderately deep	20 to 40
Shallow	less than 20

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that are not a part of the original plant community that encroach into an area and grow after the native vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface soil.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mollic epipedon. A thick, dark, humus-rich surface horizon or (horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Potential native vegetation. The stabilized plant community on a particular range site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

	Percent
Level	0 to 1
Nearly level	0 to 2
Gently undulating	0 to 3
Gently sloping or undulating	2 to 6
Moderately sloping	6 to 9
Strongly sloping	9 to 15
Moderately steep or hilly	15 to 25
Steep	25 to 40
Very steep	40 or more

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has

properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Kennebec, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	27.7	3.5	15.6	59	-29	0	0.25	0.06	0.39	1	4.1
February---	34.9	10.0	22.5	69	-28	11	.48	.08	.77	2	7.0
March------	44.3	19.6	32.0	78	-14	28	.89	.21	1.42	3	7.8
April------	61.5	33.1	47.3	91	10	70	2.13	.81	3.22	5	3.3
May--------	73.3	44.4	58.9	95	21	288	2.52	1.22	3.63	6	.1
June-------	83.2	55.0	69.1	105	35	573	3.01	1.51	4.32	7	.0
July-------	91.4	60.2	75.8	109	41	800	2.29	1.11	3.30	5	.0
August-----	90.0	58.7	74.4	109	39	756	2.23	1.02	3.26	5	.0
September--	79.5	47.8	63.7	103	25	419	1.21	.27	1.94	3	.0
October----	66.5	35.7	51.1	95	13	123	1.06	.24	1.72	2	1.1
November---	47.1	21.3	34.2	76	-6	6	.51	.04	.85	1	2.6
December---	33.9	10.2	22.1	66	-23	0	.35	.09	.55	1	4.9
Yearly:											
Average--	61.1	33.3	47.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	110	-30	---	---	---	---	---	---
Total----	---	---	---	---	---	3,074	16.93	13.75	19.85	41	30.9

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-80 at Kennebec, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 9	May 23	May 30
2 years in 10 later than--	May 4	May 18	May 25
5 years in 10 later than--	Apr. 24	May 7	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 23	Sept. 18	Sept. 10
2 years in 10 earlier than--	Sept. 29	Sept. 24	Sept. 14
5 years in 10 earlier than--	Oct. 11	Oct. 6	Sept. 23

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-80 at Kennebec, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	148	125	109
8 years in 10	155	134	116
5 years in 10	170	151	130
2 years in 10	184	168	144
1 year in 10	191	177	151

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaA	Agar silt loam, 0 to 3 percent slopes	2,580	0.2
AaB	Agar silt loam, 3 to 6 percent slopes	10,130	1.0
AaC	Agar silt loam, 6 to 9 percent slopes	1,095	0.1
Bg	Bigbend silt loam	2,390	0.2
BuA	Bullcreek clay, 0 to 6 percent slopes	19,830	1.9
BxA	Bullcreek-Slickspots complex, 0 to 6 percent slopes	1,480	0.1
CeA	Carter silt loam, 0 to 4 percent slopes	12,765	1.2
ChB	Chantier clay, 2 to 9 percent slopes	1,555	0.1
FaA	Fairlo silt loam, 0 to 3 percent slopes	2,030	0.2
FaB	Fairlo silt loam, 3 to 6 percent slopes	4,035	0.4
Fp	Fluvaquents, ponded	2,730	0.3
Hm	Hilmoe silty clay	2,650	0.3
Ho	Hoven silt loam	4,750	0.5
HrA	Hurley silt loam, 0 to 6 percent slopes	15,650	1.5
In	Inavale loamy fine sand	910	0.1
Ko	Kolls silty clay	16,735	1.6
Kp	Kolls silty clay, ponded	2,475	0.2
LaB	Lakoma silty clay, 2 to 6 percent slopes	2,080	0.2
LaC	Lakoma silty clay, 6 to 9 percent slopes	8,635	0.8
LbD	Lakoma-Okaton silty clays, 6 to 15 percent slopes	29,375	2.8
LcE	Lakoma-Okaton complex, 9 to 50 percent slopes	4,120	0.4
LoA	Lowry silt loam, 0 to 2 percent slopes	6,445	0.6
LoB	Lowry silt loam, 2 to 6 percent slopes	3,280	0.3
LoC	Lowry silt loam, 6 to 9 percent slopes	1,485	0.1
LrD	Lowry-Sully silt loams, 9 to 25 percent slopes	1,600	0.2
McA	McClure silt loam, 0 to 3 percent slopes	2,080	0.2
McB	McClure silt loam, 3 to 6 percent slopes	9,240	0.9
McC	McClure silt loam, 6 to 9 percent slopes	850	0.1
MlA	Millboro silty clay loam, 0 to 3 percent slopes	12,735	1.2
MlB	Millboro silty clay loam, 3 to 6 percent slopes	38,810	3.7
MlC	Millboro silty clay loam, 6 to 9 percent slopes	2,960	0.3
MmA	Millboro silty clay, 0 to 3 percent slopes	54,105	5.2
MmB	Millboro silty clay, 3 to 6 percent slopes	155,390	14.9
MnB	Millboro-Boro silty clays, 2 to 6 percent slopes	37,530	3.6
MnC	Millboro-Boro silty clays, 6 to 9 percent slopes	25,790	2.5
Mp	Mobridge silt loam	1,720	0.2
Mr	Munjor fine sandy loam	3,585	0.3
Mv	Munjor-Inavale complex	1,330	0.1
OhE	Okaton-Lakoma silty clays, 15 to 40 percent slopes	3,490	0.3
Ok	Onita silt loam	2,360	0.2
OlA	Opal clay, 0 to 3 percent slopes	1,890	0.2
OlB	Opal clay, 3 to 6 percent slopes	19,840	1.9
OlC	Opal clay, 6 to 9 percent slopes	25,040	2.4
OmC	Opal-Chantier clays, 2 to 9 percent slopes	13,420	1.3
OnD	Opal-Sansarc clays, 6 to 15 percent slopes	105,280	10.1
OrB	Orton loam, 2 to 7 percent slopes	735	0.1
OtA	Orton Variant loam, 0 to 2 percent slopes	495	*
OvB	Orton Variant-Valentine complex, 2 to 6 percent slopes	1,030	0.1
Pg	Pits, gravel	765	0.1
PoA	Promise clay, 0 to 3 percent slopes	47,180	4.5
PoB	Promise clay, 3 to 6 percent slopes	34,250	3.3
PoC	Promise clay, 6 to 9 percent slopes	3,910	0.4
PrA	Promise-Hurley complex, 0 to 4 percent slopes	15,025	1.4
ReB	Ree silt loam, 2 to 6 percent slopes	1,760	0.2
ReC	Ree silt loam, 6 to 9 percent slopes	960	0.1
RlA	Reliance silty clay loam, 0 to 3 percent slopes	590	0.1
RlB	Reliance silty clay loam, 3 to 6 percent slopes	1,490	0.1
RlC	Reliance silty clay loam, 6 to 9 percent slopes	595	0.1
RsE	Rock outcrop-Sansarc complex, 9 to 40 percent slopes	5,110	0.5
SaE	Sansarc clay, 15 to 40 percent slopes	45,440	4.3
SbE	Sansarc-Opal clays, 9 to 40 percent slopes	132,865	12.7
ScE	Sansarc-Rock outcrop complex, 9 to 40 percent slopes	34,715	3.3
SeE	Sansarc-Schamber complex, 9 to 40 percent slopes	3,470	0.3

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
ShE	Schamber loam, 6 to 40 percent slopes	3,450	0.3
SlE	Sully silt loam, 15 to 40 percent slopes	500	*
VaD	Valentine fine sand, 6 to 25 percent slopes	590	0.1
Wd	Wendte silty clay, channeled	17,610	1.7
Wt	Witten silty clay	8,710	0.8
	Water areas less than 40 acres in size	5,840	0.6
	Total land area	1,045,340	100.0
	Water areas more than 40 acres in size	47,025	
	Total acreage	1,092,365	

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
AaA	Agar silt loam, 0 to 3 percent slopes (where irrigated)
AaB	Agar silt loam, 3 to 6 percent slopes (where irrigated)
Bg	Bigbend silt loam (where irrigated)
FaA	Fairlo silt loam, 0 to 3 percent slopes (where irrigated)
FaB	Fairlo silt loam, 3 to 6 percent slopes (where irrigated)
Hm	Hilmoe silty clay (where irrigated)
LaB	Lakoma silty clay, 2 to 6 percent slopes (where irrigated)
LoA	Lowry silt loam, 0 to 2 percent slopes (where irrigated)
LoB	Lowry silt loam, 2 to 6 percent slopes (where irrigated)
McA	McClure silt loam, 0 to 3 percent slopes (where irrigated)
McB	McClure silt loam, 3 to 6 percent slopes (where irrigated)
MlA	Millboro silty clay loam, 0 to 3 percent slopes (where irrigated)
MlB	Millboro silty clay loam, 3 to 6 percent slopes (where irrigated)
MmA	Millboro silty clay, 0 to 3 percent slopes (where irrigated)
MmB	Millboro silty clay, 3 to 6 percent slopes (where irrigated)
Mp	Mobridge silt loam
Mr	Munjor fine sandy loam (where irrigated)
Ok	Onita silt loam
OrB	Orton loam, 2 to 7 percent slopes (where irrigated)
OtA	Orton Variant loam, 0 to 2 percent slopes (where irrigated)
ReB	Ree silt loam, 2 to 6 percent slopes (where irrigated)
RlA	Reliance silty clay loam, 0 to 3 percent slopes (where irrigated)
RlB	Reliance silty clay loam, 3 to 6 percent slopes (where irrigated)
Wt	Witten silty clay (where irrigated)

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Oats	Grain sorghum	Winter wheat*	Corn	Alfalfa hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM**
AaA---------- Agar	60	56	35	46	2.1	3.5
AaB---------- Agar	56	51	33	44	2.0	3.3
AaC---------- Agar	48	43	29	37	1.8	3.0
Bg---------- Bigbend	49	35	30	36	1.9	3.2
BuA. Bullcreek						
BxA***. Bullcreek-Slickspots						
CeA---------- Carter	40	35	28	25	1.1	1.8
ChB. Chantier						
FaA---------- Fairlo	60	54	34	45	2.0	3.3
FaB---------- Fairlo	56	50	32	43	1.9	3.2
Fp***. Fluvaquents						
Hm---------- Hilmoe	50	45	38	35	2.0	3.3
Ho. Hoven						
HrA. Hurley						
In. Inavale						
Ko, Kp. Kolls						
LaB---------- Lakoma	35	31	25	18	1.1	1.8
LaC---------- Lakoma	27	24	21	16	0.9	1.5
LbD, LcE. Lakoma-Okaton						
LoA---------- Lowry	55	50	33	38	1.9	3.2

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Grain sorghum	Winter wheat*	Corn	Alfalfa hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM**
LoB---------- Lowry	52	45	31	35	1.8	3.0
LoC---------- Lowry	41	37	24	32	1.6	2.6
LrD. Lowry-Sully						
McA---------- McClure	52	54	39	40	2.2	3.7
McB---------- McClure	50	49	37	37	2.1	3.5
McC---------- McClure	43	46	34	31	1.8	3.0
MlA---------- Millboro	54	54	40	38	2.0	3.3
MlB---------- Millboro	50	50	37	36	1.9	3.2
MlC---------- Millboro	43	40	32	31	1.6	2.6
MmA---------- Millboro	50	50	40	34	1.7	2.8
MmB---------- Millboro	48	47	38	32	1.5	2.5
MnB---------- Millboro-Boro	45	41	35	29	1.4	2.3
MnC---------- Millboro-Boro	38	36	30	23	1.3	2.0
Mp---------- Mobridge	65	63	42	57	2.8	4.7
Mr---------- Munjor	42	36	20	36	1.9	3.2
Mv---------- Munjor-Inavale	32	30	15	28	1.7	2.8
OhE. Okaton-Lakoma						
Ok---------- Onita	65	63	42	57	2.8	4.7
OlA---------- Opal	47	40	36	29	1.4	2.3
OlB---------- Opal	45	40	33	27	1.4	2.3
OlC---------- Opal	35	29	28	21	1.3	2.1

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Grain sorghum	Winter wheat*	Corn	Alfalfa hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM**
OmC. Opal-Chantier						
OnD. Opal-Sansarc						
OrB---------- Orton	33	22	15	20	1.0	1.6
OtA---------- Orton Variant	36	26	20	22	1.1	1.8
OvB---------- Orton Variant-Valentine	30	22	15	17	0.9	1.5
Pg***. Pits						
PoA---------- Promise	50	46	38	32	1.5	2.5
PoB---------- Promise	48	44	36	29	1.5	2.5
PoC---------- Promise	40	35	29	23	1.3	2.1
PrA---------- Promise-Hurley	36	33	27	21	1.2	2.0
ReB---------- Ree	52	50	33	41	1.8	3.0
ReC---------- Ree	47	39	29	34	1.4	2.3
RlA---------- Reliance	52	56	39	46	2.2	3.7
RlB---------- Reliance	50	53	37	43	2.1	3.5
RlC---------- Reliance	43	47	34	37	1.9	3.2
RsE***. Rock outcrop-Sansarc						
SaE. Sansarc						
SbE. Sansarc-Opal						
ScE***. Sansarc-Rock outcrop						
SeE. Sansarc-Schamber						
ShE. Schamber						

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Grain sorghum	Winter wheat*	Corn	Alfalfa hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM**
SlE. Sully						
VaD. Valentine						
Wd---------- Wendte	---	---	---	---	---	2.5
Wt---------- Witten	62	59	42	44	2.5	4.2

* Winter wheat is grown under a summer fallow system of management. The yields can be expected only in alternate years.

** Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
AaA, AaB, AaC---- Agar	Silty----	3,300	2,800	2,000
Bg---- Bigbend	Overflow----	3,900	3,300	2,300
BuA---- Bullcreek	Dense Clay----	2,000	1,700	1,200
BxA*: Bullcreek----	Dense Clay----	2,000	1,700	1,200
Slickspots.				
CeA---- Carter	Claypan----	2,300	1,900	1,300
ChB---- Chantier	Dense Clay----	2,100	1,600	1,000
FaA, FaB---- Fairlo	Silty----	3,300	2,800	2,000
Hm---- Hilmoe	Clayey Overflow----	3,700	3,100	2,200
Ho---- Hoven	Closed Depression----	3,300	3,000	2,100
HrA---- Hurley	Thin Claypan----	1,600	1,300	800
In---- Inavale	Sands----	3,000	2,800	2,500
Ko---- Kolls	Closed Depression----	3,400	3,100	2,200
Kp---- Kolls	Shallow Marsh----	6,500	5,900	5,000
LaB, LaC---- Lakoma	Limy Clay----	3,400	2,800	2,000
LbD*: Lakoma----	Limy Clay----	3,600	3,000	2,100
Okaton----	Shallow----	2,400	2,000	1,400
LcE*: Lakoma----	Limy Clay----	2,700	2,300	1,600
Okaton----	Shallow----	2,000	1,800	1,300
LoA, LoB---- Lowry	Silty----	3,100	2,600	1,800
LoC---- Lowry	Silty----	3,000	2,500	1,800

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
LrD*:				
Lowry	Silty	3,000	2,500	1,800
Sully	Thin Upland	2,300	1,900	1,300
McA, McB, McC McClure	Silty	3,300	2,800	2,000
MlA, MlB, MlC Millboro	Clayey	3,200	2,700	1,900
MmA, MmB Millboro	Clayey	3,000	2,500	1,800
MnB*:				
Millboro	Clayey	3,000	2,500	1,800
Boro	Clayey	2,800	2,300	1,600
MnC*:				
Millboro	Clayey	2,900	2,400	1,700
Boro	Clayey	2,800	2,300	1,600
Mp Mobridge	Overflow	4,400	3,700	2,600
Mr Munjor	Sandy	3,200	2,700	1,900
Mv*:				
Munjor	Overflow	3,900	3,300	2,200
Inavale	Sands	3,300	2,800	2,300
OhE*:				
Okaton	Shallow	2,200	1,800	1,300
Lakoma	Limy Clay	3,000	2,500	1,800
Ok Onita	Overflow	4,400	3,700	2,600
OlA, OlB Opal	Clayey	2,900	2,400	1,400
OlC Opal	Clayey	2,400	2,200	1,200
OmC*:				
Opal	Clayey	2,400	2,200	1,200
Chantier	Dense Clay	2,100	1,600	1,000
OnD*:				
Opal	Clayey	2,400	2,000	1,400
Sansarc	Shallow Clay	2,300	1,900	1,300
OrB Orton	Sandy	2,900	2,400	1,700
OtA Orton Variant	Sandy	2,900	2,400	1,700

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
OvB*:				
Orton Variant	Sandy	2,900	2,400	1,700
Valentine	Sands	3,100	2,600	1,800
PoA, PoB Promise	Clayey	2,900	2,400	1,700
PoC Promise	Clayey	2,700	2,300	1,600
PrA*:				
Promise	Clayey	2,900	2,400	1,700
Hurley	Thin Claypan	1,500	1,300	800
ReB, ReC Ree	Silty	3,400	2,800	2,000
RlA, RlB Reliance	Silty	3,400	2,800	2,000
RlC Reliance	Silty	3,200	2,700	1,900
RsE*:				
Rock outcrop.				
Sansarc	Shallow Clay	2,000	1,700	1,200
SaE Sansarc	Shallow Clay	2,000	1,700	1,200
SbE*:				
Sansarc	Shallow Clay	2,000	1,700	1,200
Opal	Clayey	2,400	2,000	1,400
ScE*:				
Sansarc	Shallow Clay	2,000	1,700	1,200
Rock outcrop.				
SeE*:				
Sansarc	Shallow Clay	2,000	1,700	1,200
Schamber	Very Shallow	1,400	1,200	700
ShE Schamber	Very Shallow	1,400	1,200	700
SlE Sully	Thin Upland	2,300	1,900	1,300
VaD Valentine	Sands	3,100	2,600	1,800
Wd Wendte	Clayey Overflow	3,500	2,900	2,000
Wt Witten	Clayey	3,800	3,200	2,200

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AaA, AaB, AaC----- Agar	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub, common chokecherry.	Ponderosa pine, honeylocust, green ash, Russian-olive, bur oak, hackberry.	Siberian elm------	---
Bg---------- Bigbend	Lilac----------	Siberian peashrub, American plum, Tatarian honeysuckle.	Hackberry, green ash, blue spruce, ponderosa pine, Russian mulberry, eastern redcedar.	Honeylocust-------	Eastern cottonwood.
BuA. Bullcreek					
BxA*: Bullcreek.					
Slickspots.					
CeA---------- Carter	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
ChB. Chantier					
FaA, FaB---------- Fairlo	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, green ash, Russian-olive, hackberry, bur oak.	Siberian elm------	---
Fp*. Fluvaquents					
Hm---------- Hilmoe	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Ho. Hoven					
HrA. Hurley					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
In---------- Inavale	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, jack pine.	---	---
Ko, Kp. Kolls					
LaB, LaC---------- Lakoma	Siberian peashrub, lilac, silver buffaloberry, skunkbush sumac.	Ponderosa pine, hackberry, Russian-olive, Rocky Mountain juniper, eastern redcedar.	Siberian elm, honeylocust, green ash.	---	---
LbD*, LcE*: Lakoma.					
Okaton.					
LoA, LoB, LoC----- Lowry	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, honeylocust, bur oak.	Siberian elm------	---
LrD*: Lowry----------	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, honeylocust, bur oak.	Siberian elm------	---
Sully.					
McA, McB, McC----- McClure	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub, common chokecherry.	Ponderosa pine, bur oak, hackberry, Russian-olive, green ash, honeylocust.	Siberian elm------	---
MlA, MlB, MlC----- Millboro	Siberian peashrub, Tatarian honeysuckle, lilac, American plum.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, ponderosa pine, green ash.	Siberian elm, honeylocust.	---	---
MmA, MmB---------- Millboro	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MnB*, MnC*: Millboro	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Boro	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Mp Mobridge	Lilac	Tatarian honeysuckle, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, green ash, hackberry, Russian mulberry, eastern redcedar.	Honeylocust	Eastern cottonwood.
Mr Munjor	Lilac	Tatarian honeysuckle, American plum.	Ponderosa pine, Russian-olive, green ash, eastern redcedar, hackberry, blue spruce.	Siberian elm, honeylocust.	Eastern cottonwood.
Mv*: Munjor	Lilac	Tatarian honeysuckle, American plum.	Ponderosa pine, Russian-olive, green ash, eastern redcedar, hackberry, blue spruce.	Siberian elm, honeylocust.	Eastern cottonwood.
Inavale	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, jack pine.	---	---
OhE*: Okaton. Lakoma.					
Ok Onita	Lilac	Tatarian honeysuckle, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, green ash, hackberry, Russian mulberry, eastern redcedar.	Honeylocust	Eastern cottonwood.
O1A, O1B, O1C Opal	Tatarian honeysuckle, Siberian peashrub, skunkbush sumac, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper.	Green ash, honeylocust, Siberian elm.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
OmC*:					
Opal	Tatarian honeysuckle, Siberian peashrub, skunkbush sumac, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper.	Green ash, honeylocust, Siberian elm.	---	---
Chantier.					
OnD*:					
Opal.					
Sansarc.					
OrB	Siberian peashrub, Peking cotoneaster, lilac.	Ponderosa pine, Manchurian crabapple, Russian-olive, eastern redcedar, bur oak, Rocky Mountain juniper.	Siberian elm, green ash, honeylocust.	---	---
Orton					
OtA	Tatarian honeysuckle, lilac, skunkbush sumac.	Russian-olive, eastern redcedar, Manchurian crabapple, Siberian peashrub.	Honeylocust, green ash, hackberry, ponderosa pine.	Siberian elm	---
Orton Variant					
OvB*:					
Orton Variant	Tatarian honeysuckle, lilac, skunkbush sumac.	Russian-olive, eastern redcedar, Manchurian crabapple, Siberian peashrub.	Honeylocust, green ash, hackberry, ponderosa pine.	Siberian elm	---
Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Pg*.					
Pits					
PoA, PoB, PoC	American plum, Tatarian honeysuckle, Siberian peashrub, lilac.	Green ash, Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper, ponderosa pine.	Honeylocust, Siberian elm.	---	---
Promise					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
PrA*: Promise	American plum, Tatarian honeysuckle, Siberian peashrub, lilac.	Green ash, Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper, ponderosa pine.	Honeylocust, Siberian elm.	---	---
Hurley.					
ReB, ReC Ree	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub, common chokecherry.	Ponderosa pine, honeylocust, green ash, Russian-olive, bur oak, hackberry.	Siberian elm	---
RlA, RlB, RlC Reliance	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub, common chokecherry.	Ponderosa pine, honeylocust, green ash, Russian-olive, bur oak, hackberry.	Siberian elm	---
RsE*: Rock outcrop.					
Sansarc.					
SaE. Sansarc					
SbE*: Sansarc.					
Opal.					
ScE*: Sansarc.					
Rock outcrop.					
SeE*: Sansarc.					
Schamber.					
ShE. Schamber					
SlE. Sully					
VaD Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Wd---------- Wendte	Siberian peashrub, Tatarian honeysuckle, lilac, skunkbush sumac.	Hackberry, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust, green ash.	---	---
Wt---------- Witten	Tatarian honeysuckle, Siberian peashrub, skunkbush sumac, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper.	Green ash, Siberian elm, honeylocust.	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AaA--- Agar	Slight---	Slight---	Slight---	Slight.
AaB--- Agar	Slight---	Slight---	Moderate: slope.	Slight.
AaC--- Agar	Slight---	Slight---	Severe: slope.	Slight.
Bg--- Bigbend	Severe: flooding.	Slight---	Slight---	Slight.
BuA--- Bullcreek	Severe: flooding.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
BxA*: Bullcreek---	Severe: flooding.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
Slickspots.				
CeA--- Carter	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight.
ChB--- Chantier	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.
FaA--- Fairlo	Slight---	Slight---	Slight---	Slight.
FaB--- Fairlo	Slight---	Slight---	Moderate: slope.	Slight.
Fp*. Fluvaquents				
Hm--- Hilmoe	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Ho--- Hoven	Severe: ponding, percs slowly, excess sodium.	Severe: ponding, excess sodium, percs slowly.	Severe: ponding, percs slowly, excess sodium.	Severe: ponding.
HrA--- Hurley	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.
In--- Inavale	Severe: flooding.	Slight---	Slight---	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ko, Kp Kolls	Severe: ponding, percs slowly, too clayey.	Severe: too clayey, ponding, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: too clayey, ponding.
LaB Lakoma	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope, depth to rock.	Moderate: too clayey.
LaC Lakoma	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
LbD*: Lakoma	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Severe: erodes easily.
Okaton	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
LcE*: Lakoma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Okaton	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: slope, erodes easily.
LoA Lowry	Slight	Slight	Slight	Slight.
LoB Lowry	Slight	Slight	Moderate: slope.	Slight.
LoC Lowry	Slight	Slight	Severe: slope.	Slight.
LrD*: Lowry	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
McA McClure	Slight	Slight	Slight	Slight.
McB McClure	Slight	Slight	Moderate: slope.	Slight.
McC McClure	Slight	Slight	Severe: slope.	Slight.
MlA Millboro	Slight	Slight	Slight	Moderate: too clayey.
MlB Millboro	Slight	Slight	Moderate: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
M1C---------- Millboro	Slight----------	Slight----------	Severe: slope.	Moderate: too clayey.
MmA---------- Millboro	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
MmB---------- Millboro	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
MnB*: Millboro----------	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
Boro----------	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
MnC*: Millboro----------	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Boro----------	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Mp---------- Mobridge	Severe: flooding.	Slight----------	Moderate: flooding.	Slight.
Mr---------- Munjor	Severe: flooding.	Slight----------	Slight----------	Slight.
Mv*: Munjor----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight.
Inavale----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
OhE*: Okaton----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Lakoma----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Ok---------- Onita	Severe: flooding.	Slight----------	Moderate: flooding.	Slight.
O1A---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.
O1B---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
O1C---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
OmC*:				
Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Chantier	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.
OnD*:				
Opal	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Sansarc	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
OrB Orton	Slight	Slight	Moderate: slope, small stones.	Slight.
OtA Orton Variant	Slight	Slight	Moderate: small stones.	Slight.
OvB*:				
Orton Variant	Slight	Slight	Moderate: slope, small stones.	Slight.
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Pg*. Pits				
PoA Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
PoB Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
PoC Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
PrA*:				
Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Hurley	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.
ReB Ree	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ReC---------- Ree	Slight----------	Slight----------	Severe: slope.	Slight.
RlA---------- Reliance	Slight----------	Slight----------	Slight----------	Slight.
RlB---------- Reliance	Slight----------	Slight----------	Moderate: slope.	Slight.
RlC---------- Reliance	Slight----------	Slight----------	Severe: slope.	Slight.
RsE*: Rock outcrop.				
Sansarc----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
SaE---------- Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
SbE*: Sansarc----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Opal----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
ScE*: Sansarc----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Rock outcrop.				
SeE*: Sansarc----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Schamber----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ShE---------- Schamber	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SlE---------- Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
VaD---------- Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Wd---------- Wendte	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Wt---------- Witten	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees and shrubs	Native coniferous plants	Native shrubs	Native hardwood trees	Wetland plants	Shallow water areas
AaA, AaB---------- Agar	Good	Good	Good	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
AaC---------- Agar	Fair	Good	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Bg---------- Bigbend	Good	Good	Fair	Good	Fair	Good	Good	Very poor	Very poor.
BuA---------- Bullcreek	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
BxA*: Bullcreek--------- Slickspots.	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
CeA---------- Carter	Poor	Poor	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
ChB---------- Chantier	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
FaA, FaB---------- Fairlo	Good	Good	Good	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
Fp*. Fluvaquents									
Hm---------- Hilmoe	Good	Fair	Fair	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Ho---------- Hoven	Very poor.	Poor	Poor	Poor	Very poor	Very poor.	Very poor	Good	Good.
HrA---------- Hurley	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
In---------- Inavale	Very poor.	Very poor.	Fair	Poor	Fair	Good	Good	Very poor	Very poor.
Ko---------- Kolls	Very poor.	Poor	Poor	Poor	Very poor	Very poor.	Very poor	Good	Good.
Kp---------- Kolls	Very poor.	Very poor.	Very poor	Poor	Very poor	Very poor.	Very poor	Good	Good.
LaB---------- Lakoma	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
LaC---------- Lakoma	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.

See footnotes at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees and shrubs	Native coniferous plants	Native shrubs	Native hardwood trees	Wetland plants	Shallow water areas
LbD*:									
Lakoma	Very poor.	Very poor.	Good	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Okaton	Very poor.	Very poor.	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
LcE*:									
Lakoma	Very poor.	Very poor.	Good	Poor	Poor	Fair	Very poor	Very poor	Very poor.
Okaton	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor	Very poor	Very poor.
LoA, LoB Lowry	Good	Good	Good	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
LoC Lowry	Fair	Good	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
LrD*:									
Lowry	Poor	Good	Good	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Sully	Very poor.	Fair	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
McA, McB McClure	Good	Good	Good	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
McC McClure	Fair	Good	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
MlA, MlB Millboro	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
MlC Millboro	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Good.
MmA, MmB Millboro	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Good.
MnB*:									
Millboro	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Boro	Fair	Good	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
MnC*:									
Millboro	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Boro	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Mp Mobridge	Good	Good	Fair	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
Mr Munjor	Fair	Fair	Fair	Good	Fair	Good	Good	Very poor	Very poor.

See footnotes at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees and shrubs	Native coniferous plants	Native shrubs	Native hardwood trees	Wetland plants	Shallow water areas
Mv*:									
Munjor	Fair	Fair	Fair	Good	Fair	Good	Good	Very poor	Very poor.
Inavale	Very poor.	Very poor.	Fair	Poor	Fair	Good	Good	Very poor	Very poor.
OhE*:									
Okaton	Very poor.	Very poor.	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Lakoma	Very poor.	Very poor.	Good	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Ok Onita	Good	Good	Fair	Good	Very poor	Very poor.	Very poor	Very poor	Very poor.
O1A, O1B Opal	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
O1C Opal	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
OmC*:									
Opal	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Chantier	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
OnD*:									
Opal	Very poor.	Fair	Good	Poor	Poor**	Poor**	Very poor	Very poor	Very poor.
Sansarc	Very poor.	Very poor.	Fair	Poor	Poor**	Poor**	Very poor	Very poor	Very poor.
OrB Orton	Fair	Fair	Good	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
OtA Orton Variant	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
OvB*:									
Orton Variant	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
Valentine	Very poor.	Very poor.	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Pg*. Pits									
PoA, PoB Promise	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
PoC Promise	Poor	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
PrA*:									
Promise	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.

See footnotes at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees and shrubs	Native coniferous plants	Native shrubs	Native hardwood trees	Wetland plants	Shallow water areas
PrA*: Hurley	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
ReB, ReC Ree	Good / Fair	Good	Good	Good / Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
RlA, RlB, RlC Reliance	Good / Fair	Good	Good	Good / Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.
RsE*: Rock outcrop.									
Sansarc	Very poor.	Very poor.	Fair	Poor	Poor	Fair**	Very poor	Very poor	Very poor.
SaE Sansarc	Very poor.	Very poor.	Fair	Poor	Poor**	Fair**	Very poor	Very poor	Very poor.
SbE*: Sansarc	Very poor.	Very poor.	Fair	Poor	Poor**	Fair**	Very poor	Very poor	Very poor.
Opal	Very poor.	Very poor.	Good	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
ScE*: Sansarc	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor	Very poor	Very poor.
Rock outcrop.									
SeE*: Sansarc	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor	Very poor	Very poor.
Schamber	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
ShE Schamber	Very poor.	Very poor.	Poor	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
SlE Sully	Very poor.	Very poor.	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
VaD Valentine	Poor	Very poor.	Fair	Poor	Very poor	Very poor.	Very poor	Very poor	Very poor.
Wd Wendte	Very poor.	Fair	Fair	Fair	Very poor	Poor	Fair	Very poor	Very poor.
Wt Witten	Fair	Fair	Good	Fair	Very poor	Very poor.	Very poor	Very poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.
** The rating applies only to areas in draws.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaA---------- Agar	Slight----------	Slight----------	Slight----------	Slight----------	Severe: low strength.
AaB, AaC---------- Agar	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.
Bg---------- Bigbend	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.
BuA---------- Bullcreek	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
BxA*: Bullcreek--------	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
CeA---------- Carter	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ChB---------- Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
FaA---------- Fairlo	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
FaB---------- Fairlo	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Fp*. Fluvaquents					
Hm---------- Hilmoe	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, shrink-swell, flooding.
Ho---------- Hoven	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength, shrink-swell.
HrA---------- Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
In Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Ko, Kp Kolls	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, shrink-swell.
LaB, LaC Lakoma	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
LbD*: Lakoma	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Okaton	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
LcE*: Lakoma	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Okaton	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
LoA Lowry	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
LoB, LoC Lowry	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
LrD*: Lowry	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McA, McB, McC McClure	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
M1A, M1B, M1C, MmA, MmB Millboro	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
MnB*, MnC*:					
Millboro	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Boro	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Mp Mobridge	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Mr Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Mv*:					
Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
OhE*:					
Okaton	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Lakoma	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Ok Onita	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
OlA, OlB, OlC Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OmC*:					
Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
OnD*:					
Opal	Moderate: too clayey, depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Sansarc	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
OrB---------- Orton	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
OtA---------- Orton Variant	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
OvB*: Orton Variant----	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Valentine--------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Pg*. Pits					
PoA, PoB, PoC----- Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PrA*: Promise----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hurley----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
ReB, ReC---------- Ree	Slight----------	Moderate: shrink-swell.	Slight----------	Moderate: slope, shrink-swell.	Severe: low strength.
RlA, RlB, RlC----- Reliance	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
RsE*: Rock outcrop.					
Sansarc----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
SaE---------- Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
SbE*: Sansarc----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Opal----------	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ScE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Rock outcrop.					
SeE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ShE Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SlE Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaD Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wd Wendte	Moderate: flooding, too clayey.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, low strength, flooding.
Wt Witten	Moderate: flooding, too clayey.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaA---- Agar	Slight----	Moderate: seepage.	Slight----	Slight----	Good.
AaB---- Agar	Slight----	Moderate: slope, seepage.	Slight----	Slight----	Good.
AaC---- Agar	Slight----	Severe: slope.	Slight----	Slight----	Good.
Bg---- Bigbend	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
BuA---- Bullcreek	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
BxA*: Bullcreek----	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Slickspots.					
CeA---- Carter	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey, hard to pack.
ChB---- Chantier	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
FaA---- Fairlo	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----	Poor: too clayey, hard to pack.
FaB---- Fairlo	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----	Poor: too clayey, hard to pack.
Fp*. Fluvaquents					
Hm---- Hilmoe	Severe: percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ho---- Hoven	Severe: percs slowly, ponding.	Slight----	Severe: too clayey, ponding, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HrA---------- Hurley	Severe: percs slowly.	Slight----------	Severe: excess sodium.	Slight----------	Poor: hard to pack, excess sodium.
In---------- Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy, flooding.	Severe: seepage, flooding.	Poor: too sandy, seepage.
Ko, Kp---------- Kolls	Severe: percs slowly, ponding.	Slight----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
LaB---------- Lakoma	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
LaC---------- Lakoma	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
LbD*:					
Lakoma----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
Okaton----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
LcE*:					
Lakoma----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Okaton----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
LoA---------- Lowry	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.
LoB---------- Lowry	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
LoC---------- Lowry	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
LrD*:					
Lowry----------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Sully----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
McA---------- McClure	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
McB---------- McClure	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
McC---------- McClure	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MlA---------- Millboro	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MlB---------- Millboro	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MlC---------- Millboro	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MmA---------- Millboro	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MmB---------- Millboro	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MnB*: Millboro----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Boro----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MnC*: Millboro----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Boro----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Mp---------- Mobridge	Severe: flooding.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Mr---------- Munjor	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Mv*: Munjor----------	Severe: flooding.	Severe: seepage, flooding.	Severe: seepage, flooding.	Severe: seepage, flooding.	Fair: thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mv*: Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy, flooding.	Severe: seepage, flooding.	Poor: too sandy, seepage.
OhE*: Okaton	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
Lakoma	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Ok Onita	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
OlA, OlB Opal	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
OlC Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
OmC*: Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
Chantier	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
OnD*: Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
Sansarc	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, hard to pack.
OrB Orton	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
OtA Orton Variant	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Fair: too sandy.
OvB*: Orton Variant	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Fair: too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OvB*: Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pg*. Pits					
PoA Promise	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PoB Promise	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PoC Promise	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PrA*: Promise	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Hurley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
ReB Ree	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
ReC Ree	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
RlA Reliance	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
RlB Reliance	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RlC Reliance	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RsE*: Rock outcrop.					
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.
SaE Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SbE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.
Opal	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.
ScE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.
Rock outcrop.					
SeE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, depth to rock, hard to pack.
Schamber	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
ShE	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
Schamber					
SlE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sully					
VaD	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Valentine					
Wd	Severe: percs slowly, flooding.	Severe: flooding.	Severe: too clayey, flooding.	Severe: flooding.	Poor: too clayey, hard to pack.
Wendte					
Wt	Severe: percs slowly, flooding.	Slight	Severe: too clayey, flooding.	Severe: flooding.	Poor: too clayey, hard to pack.
Witten					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaA, AaB, AaC--------- Agar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bg-------------------- Bigbend	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
BuA------------------- Bullcreek	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BxA*: Bullcreek------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Slickspots.				
CeA------------------- Carter	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
ChB------------------- Chantier	Poor: depth to rock, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
FaA, FaB-------------- Fairlo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Fp*. Fluvaquents				
Hm-------------------- Hilmoe	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ho-------------------- Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
HrA------------------- Hurley	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
In-------------------- Inavale	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Ko, Kp---------------- Kolls	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LaB, LaC---------- Lakoma	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LbD*: Lakoma----------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Okaton----------	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
LcE*: Lakoma----------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Okaton----------	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, slope.
LoA, LoB, LoC---------- Lowry	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LrD*: Lowry----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Sully----------	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
McA, McB, McC---------- McClure	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
M1A, M1B, M1C, MmA, MmB---------- Millboro	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MnB*, MnC*: Millboro----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Boro----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Mp---------- Mobridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Mr---------- Munjor	Good----------	Probable----------	Improbable: too sandy.	Good.
Mv*: Munjor----------	Good----------	Probable----------	Improbable: too sandy.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mv*:				
Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
OhE*:				
Okaton	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, slope.
Lakoma	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Ok	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Onita				
OlA, OlB, OlC	Poor: shrink-swell, low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Opal				
OmC*:				
Opal	Poor: shrink-swell, low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Chantier	Poor: depth to rock, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
OnD*:				
Opal	Poor: shrink-swell, low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Sansarc	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, depth to rock.
OrB	Good	Probable	Probable	Poor: small stones, area reclaim.
Orton				
OtA	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Orton Variant				
OvB*:				
Orton Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy, area reclaim.
Pg*.				
Pits				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PoA, PoB, PoC--------- Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PrA*: Promise----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hurley----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
ReB, ReC---------- Ree	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RlA, RlB, RlC--------- Reliance	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
RsE*: Rock outcrop.				
Sansarc----------	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, depth to rock.
SaE---------- Sansarc	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, depth to rock.
SbE*: Sansarc----------	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, depth to rock.
Opal----------	Poor: shrink-swell, low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
ScE*: Sansarc----------	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, depth to rock.
Rock outcrop.				
SeE*: Sansarc----------	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, depth to rock.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SeE*: Schamber	Poor: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
ShE---- Schamber	Poor: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
SlE---- Sully	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
VaD---- Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope, area reclaim.
Wd---- Wendte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Wt---- Witten	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AaA---------- Agar	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
AaB, AaC---------- Agar	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Bg---------- Bigbend	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
BuA---------- Bullcreek	Moderate: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
BxA*: Bullcreek--------	Moderate: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
Slickspots.						
CeA---------- Carter	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
ChB---------- Chantier	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
FaA---------- Fairlo	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
FaB---------- Fairlo	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly---	Percs slowly.
Fp*. Fluvaquents						
Hm---------- Hilmoe	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Ho---------- Hoven	Slight---------	Severe: hard to pack, ponding, excess sodium.	Percs slowly, ponding, excess salt.	Ponding, percs slowly, excess sodium.	Wetness, percs slowly.	Percs slowly, wetness, excess sodium.
HrA---------- Hurley	Moderate: slope.	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily	Excess sodium, erodes easily.
In---------- Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ko, Kp---------- Kolls	Slight---------	Severe: hard to pack, ponding.	Percs slowly, ponding.	Slow intake, ponding.	Ponding, erodes easily, percs slowly.	Wetness, erodes easily.
LaB, LaC---------- Lakoma	Moderate: depth to rock, slope.	Slight---------	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
LbD*:						
Lakoma----------	Severe: slope.	Slight---------	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Okaton----------	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
LcE*:						
Lakoma----------	Severe: slope.	Slight---------	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Okaton----------	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Large stones, slope, erodes easily.
LoA---------- Lowry	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
LoB, LoC---------- Lowry	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
LrD*:						
Lowry----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Sully----------	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
McA---------- McClure	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
McB, McC---------- McClure	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Percs slowly---	Percs slowly.
MlA---------- Millboro	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
MlB, MlC---------- Millboro	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, erodes easily.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
MmA---------- Millboro	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
MmB---------- Millboro	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MnB*, MnC*: Millboro	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
Boro	Moderate: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
Mp Mobridge	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Mr Munjor	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Soil blowing	Favorable.
Mv*: Munjor	Severe: seepage.	Severe: piping.	Deep to water	Flooding	Soil blowing	Favorable.
Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
OhE*: Okaton	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Lakoma	Severe: slope.	Slight	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Ok Onita	Slight	Moderate: hard to pack, piping, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Erodes easily.
OlA Opal	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily.
OlB, OlC Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Depth to rock, erodes easily.	Erodes easily.
OmC*: Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Depth to rock, erodes easily.	Erodes easily.
Chantier	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
OnD*: Opal	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily.
Sansarc	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
OrB---------- Orton	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy------	Droughty.
OtA---------- Orton Variant	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Too sandy------	Favorable.
OvB*: Orton Variant----	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Too sandy------	Favorable.
Valentine--------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Pg*. Pits						
PoA---------- Promise	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
PoB, PoC---------- Promise	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
PrA*: Promise----------	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
Hurley----------	Slight---------	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily	Excess sodium, erodes easily.
ReB, ReC---------- Ree	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
RlA---------- Reliance	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Favorable------	Favorable.
RlB, RlC---------- Reliance	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
RsE*: Rock outcrop.						
Sansarc----------	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.
SaE---------- Sansarc	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
SbE*:						
Sansarc	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.
Opal	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily.
ScE*:						
Sansarc	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.
Rock outcrop.						
SeE*:						
Sansarc	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, erodes easily.
Schamber	Severe: slope, seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
ShE	Severe: slope, seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Schamber						
SlE	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
Sully						
VaD	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Valentine						
Wd	Slight	Severe: hard to pack.	Deep to water	Flooding, percs slowly, slow intake.	Percs slowly	Percs slowly.
Wendte						
Wt	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Witten						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AaA, AaB, AaC---- Agar	0-8	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	8-26	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	26-44	Silty clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	44-60	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-50	5-22
Bg---------- Bigbend	0-3	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	25-40	4-15
	3-60	Stratified very fine sandy loam to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	55-95	20-35	4-15
BuA---------- Bullcreek	0-2	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	30-60
	2-8	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	8-16	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	16-60	Clay-------------	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
BxA*: Bullcreek-------	0-2	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	30-60
	2-8	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	8-16	Clay-------------	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	16-60	Clay-------------	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
Slickspots.											
CeA---------- Carter	0-7	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	7-28	Clay-------------	CH, MH	A-7	0	100	100	90-100	90-100	60-85	25-50
	28-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	90-100	55-80	25-50
ChB---------- Chantier	0-2	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	2-15	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	15-19	Clay-------------	CH	A-7	0	100	95-100	80-100	75-100	65-105	40-80
	19-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FaA, FaB--------- Fairlo	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	80-90	25-40	5-15
	9-18	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	10-25
	18-29	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	10-25
	29-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-60	20-30
Fp*. Fluvaquents											
Hm---------- Hilmoe	0-11	Silty clay-------	CL, CH	A-7	0	100	95-100	95-100	80-100	40-60	15-30
	11-25	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	40-65	15-35
	25-60	Stratified very fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	55-80	25-40	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ho---------- Hoven	0-2	Silt loam---------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	2-10	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	10-30	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	30-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
HrA----------	0-2	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hurley	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	85-100	80-100	60-90	30-50
In---------- Inavale	0-4	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	4-8	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Ko, Kp----------	0-3	Silty clay-------	CH, MH	A-7	0	100	100	95-100	85-100	50-90	25-50
Kolls	3-60	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	60-90	25-55
LaB, LaC--------- Lakoma	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-17	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	17-25	Shaly silty clay, shaly clay, silty clay.	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LbD*: Lakoma----------	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-17	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	17-25	Shaly silty clay, shaly clay, silty clay.	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Okaton----------	0-3	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	3-12	Clay, silty clay, shaly clay.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LcE*: Lakoma----------	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-17	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	17-25	Shaly silty clay, shaly clay, silty clay.	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Okaton----------	0-3	Silty clay-------	CH, MH	A-7	25-50	100	95-100	90-100	85-100	50-85	20-50
	3-12	Clay, silty clay, shaly clay.	CH, MH	A-7	25-50	100	95-100	90-100	85-100	50-85	20-50
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LoA, LoB, LoC---- Lowry	0-8	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	8-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	13-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	3-15
LrD*:											
Lowry----------	0-8	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	8-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	13-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	3-15
Sully----------	0-4	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
	4-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	85-100	20-40	3-15
McA, McB, McC---- McClure	0-5	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	5-20	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-35
	20-60	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	80-100	50-100	25-65
MlA, MlB, MlC---- Millboro	0-6	Silty clay loam	CL, CH, MH	A-7	0	100	100	90-100	75-100	45-70	15-35
	6-18	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
	18-60	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
MmA, MmB--------- Millboro	0-5	Silty clay-------	CL, CH, MH	A-7	0	100	100	90-100	75-100	45-70	15-35
	5-18	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
	18-60	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
MnB*, MnC*:											
Millboro--------	0-5	Silty clay-------	CL, CH, MH	A-7	0	100	100	90-100	75-100	45-70	15-35
	5-18	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
	18-60	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
Boro----------	0-4	Silty clay-------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-40
	4-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	30-40
Mp---------- Mobridge	0-12	Silt loam--------	ML, CL	A-6, A-4, A-7	0	100	100	90-100	70-100	30-45	5-20
	12-30	Silty clay loam, clay loam.	CL, ML, CH, MH	A-6, A-7	0	100	100	95-100	85-100	35-55	10-30
	30-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	95-100	85-100	35-55	15-35
Mr---------- Munjor	0-6	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-100	30-55	15-30	NP-7
	6-36	Fine sandy loam, loamy very fine sand, loam.	SM, SC, ML, CL	A-4	0	100	95-100	85-100	35-65	15-30	3-10
	36-60	Loamy sand, sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	98-100	95-100	55-100	5-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mv*:											
Munjor	0-6	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-100	30-55	15-30	NP-7
	6-30	Fine sandy loam, loamy very fine sand, loam.	SM, SC, ML, CL	A-4	0	100	95-100	85-100	35-65	15-30	3-10
	30-60	Loamy sand, sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	98-100	95-100	55-100	5-30	---	NP
Inavale	0-4	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	4-8	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
OhE*:											
Okaton	0-3	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	3-12	Clay, silty clay, shaly clay.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Lakoma	0-5	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-17	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	17-25	Shaly silty clay, shaly clay, silty clay.	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ok	0-20	Silt loam	CL, ML	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	7-20
Onita	20-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	75-100	40-60	15-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
O1A, O1B, O1C	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	25-45
Opal	5-21	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-85	30-50
	21-32	Clay, shaly clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	80-100	65-85	30-50
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OmC*:											
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	25-45
	5-21	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-85	30-50
	21-32	Clay, shaly clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	80-100	65-85	30-50
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Chantier	0-2	Clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	2-15	Clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	15-19	Clay	CH	A-7	0	100	95-100	80-100	75-100	65-105	40-80
	19-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OnD*:											
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	25-45
	5-21	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-85	30-50
	21-32	Clay, shaly clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	80-100	65-85	30-50
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sansarc	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OrB	0-5	Loam	ML, CL	A-4, A-6	0	95-100	85-100	75-90	55-80	30-40	5-15
Orton	5-30	Fine sandy loam, loam.	SM, ML, SM-SC, CL-ML	A-4	0	95-100	85-100	70-95	35-75	20-35	NP-10
	30-60	Gravelly loamy sand, very gravelly sand.	GW, GM, SW, SM	A-1, A-2	0-5	30-60	25-60	15-40	0-30	<25	NP-5
OtA	0-5	Loam	ML, CL	A-4, A-6	0	95-100	85-100	75-90	50-75	30-40	5-15
Orton Variant	5-16	Fine sandy loam, sandy loam.	SM, ML, SC, CL	A-4, A-2	0	95-100	85-100	60-90	30-55	<30	5-10
	16-44	Fine sandy loam, sandy loam, loamy sand.	SM, SM-SC	A-4, A-2	0	95-100	85-100	55-85	15-50	<25	NP-7
	44-60	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-40	3-15
OvB*:											
Orton Variant	0-5	Loam	ML, CL	A-4, A-6	0	95-100	85-100	75-90	50-75	30-40	5-15
	5-16	Fine sandy loam, sandy loam.	SM, ML, SC, CL	A-4, A-2	0	95-100	85-100	60-90	30-55	<30	5-10
	16-44	Fine sandy loam, sandy loam, loamy sand.	SM, SM-SC	A-4, A-2	0	95-100	85-100	55-85	15-50	<25	NP-7
	44-60	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-40	3-15
Valentine	0-14	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	14-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Pg*. Pits											
PoA, PoB, PoC	0-7	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-70	25-40
Promise	7-21	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	21-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
PrA*:											
Promise	0-7	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-70	25-40
	7-21	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	21-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
Hurley	0-2	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	85-100	80-100	60-90	30-50

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ReB, ReC, Ree	0-10	Silt loam	CL, ML	A-4, A-6, A-7	0	95-100	90-100	80-100	70-95	30-45	8-20
	10-27	Clay loam, sandy clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	70-100	65-85	30-45	10-20
	27-60	Stratified fine sandy loam to clay loam.	CL, CL-ML, SM-SC, SC	A-4, A-6, A-7	0	95-100	85-100	70-100	35-85	25-45	5-22
R1A, R1B, R1C---- Reliance	0-11	Silty clay loam	CL, ML, CH, MH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-25
	11-27	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	27-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-100	30-55	10-30
RsE*:											
Rock outcrop.											
Sansarc	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SaE	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
Sansarc	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SbE*:											
Sansarc	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Opal	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	25-45
	5-21	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-85	30-50
	21-32	Clay, shaly clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	80-100	65-85	30-50
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ScE*:											
Sansarc	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
SeE*:											
Sansarc	0-3	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	3-15	Clay	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Schamber	0-5	Loam	ML, SM, SC, CL	A-4, A-6	0-5	95-100	80-95	65-95	40-70	25-40	3-15
	5-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-80	25-50	5-20	0-10	<25	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ShE---------- Schamber	0-5	Loam----------	ML, SM, SC, CL	A-4, A-6	0-5	95-100	80-95	65-95	40-70	25-40	3-15
	5-60	Very gravelly loamy sand, gravelly loamy sand, gravelly sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-80	25-50	5-20	0-10	<25	NP-5
SlE---------- Sully	0-4	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
	4-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	85-100	20-40	3-15
VaD---------- Valentine	0-14	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	14-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Wd---------- Wendte	0-5	Silty clay-------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-45
Wt---------- Witten	0-8	Silty clay-------	CH, MH	A-7	0	100	100	95-100	90-100	50-80	20-50
	8-24	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-85	30-55
	24-60	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-80	30-50

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
AaA, AaB, AaC----	0-8	20-28	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6	2-4
Agar	8-26	24-35	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.43			
	26-44	25-35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low-------	0.43			
	44-60	20-30	0.6-2.0	0.17-0.20	7.4-9.0	<2	Low-------	0.43			
Bg----------	0-3	10-20	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	0.32	5	4L	1-3
Bigbend	3-60	10-18	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low-------	0.43			
BuA----------	0-2	55-65	<0.06	0.10-0.14	6.6-8.4	<2	Very high	0.37	5	4	2-4
Bullcreek	2-8	60-70	<0.06	0.10-0.14	7.4-9.0	<4	Very high	0.37			
	8-16	60-70	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	16-60	60-70	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
BxA*:											
Bullcreek-------	0-2	55-65	<0.06	0.10-0.14	6.6-8.4	<2	Very high	0.37	5	4	2-4
	2-8	60-70	<0.06	0.10-0.14	7.4-9.0	<4	Very high	0.37			
	8-16	60-70	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	16-60	60-70	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Slickspots.											
CeA----------	0-7	20-26	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.37	3	6	2-4
Carter	7-28	60-70	<0.06	0.08-0.14	6.6-8.4	2-8	Very high	0.37			
	28-60	45-60	<0.2	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
ChB----------	0-2	60-70	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	2	4	1-2
Chantier	2-15	60-75	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	15-19	60-75	<0.06	0.04-0.06	7.4-9.0	4-16	Very high	0.37			
	19-60	---	---	---	---	---	----------	----			
FaA, FaB---------	0-9	22-27	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6	2-4
Fairlo	9-18	26-35	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.32			
	18-29	26-35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	29-60	35-55	0.06-0.2	0.11-0.17	7.4-8.4	2-4	High------	0.32			
Fp*.											
Fluvaquents											
Hm----------	0-11	35-50	0.06-0.2	0.19-0.22	7.4-8.4	<2	High------	0.37	5	4	2-4
Hilmoe	11-25	35-60	0.06-0.2	0.17-0.20	7.4-8.4	<2	High------	0.37			
	25-60	20-30	0.6-2.0	0.16-0.20	7.4-8.4	<4	Moderate	0.28			
Ho----------	0-2	22-26	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.37	1	6	2-4
Hoven	2-10	35-60	<0.06	0.10-0.19	6.1-7.8	4-16	High------	0.37			
	10-30	35-60	<0.06	0.10-0.19	7.4-8.4	4-16	High------	0.37			
	30-60	35-60	<0.2	0.08-0.17	7.4-9.0	4-16	High------	0.37			
HrA----------	0-2	20-26	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	1	6	1-2
Hurley	2-60	60-70	<0.06	0.05-0.13	7.4-9.0	4-16	Very high	0.43			
In----------	0-4	7-15	6.0-20	0.10-0.12	6.1-7.8	<2	Low-------	0.17	5	2	.5-1
Inavale	4-8	3-10	6.0-20	0.06-0.11	6.6-8.4	<2	Low-------	0.17			
	8-60	3-10	6.0-20	0.05-0.10	6.6-8.4	<2	Low-------	0.17			
Ko, Kp----------	0-3	45-60	<0.06	0.10-0.14	7.4-8.4	<2	Very high	0.37	5	4	2-4
Kolls	3-60	60-70	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
LaB, LaC--------- Lakoma	0-5 5-17 17-25 25-60	45-60 45-60 45-60 ---	0.06-0.2 0.06-0.2 0.06-0.2 ---	0.08-0.12 0.08-0.12 0.08-0.12 ---	7.4-8.4 7.4-8.4 7.4-8.4 ---	<2 <2 <2 ---	High------ High------ High------ ----------	0.37 0.37 0.37 ----	4	4	1-3
LbD*: Lakoma----------	0-5 5-17 17-25 25-60	45-60 45-60 45-60 ---	0.06-0.2 0.06-0.2 0.06-0.2 ---	0.08-0.12 0.08-0.12 0.08-0.12 ---	7.4-8.4 7.4-8.4 7.4-8.4 ---	<2 <2 <2 ---	High------ High------ High------ ----------	0.37 0.37 0.37 ----	4	4	1-3
Okaton----------	0-3 3-12 12-60	45-60 45-60 ---	0.06-0.2 0.06-0.2 ---	0.11-0.16 0.11-0.16 ---	7.4-8.4 7.4-8.4 ---	<2 <2 ---	High------ High------ ----------	0.37 0.37 ----	2	4	1-2
LcE*: Lakoma----------	0-5 5-17 17-25 25-60	45-60 45-60 45-60 ---	0.06-0.2 0.06-0.2 0.06-0.2 ---	0.08-0.12 0.08-0.12 0.08-0.12 ---	7.4-8.4 7.4-8.4 7.4-8.4 ---	<2 <2 <2 ---	High------ High------ High------ ----------	0.37 0.37 0.37 ----	4	4	1-3
Okaton----------	0-3 3-12 12-60	45-60 45-60 ---	0.06-0.2 0.06-0.2 ---	0.11-0.16 0.11-0.16 ---	7.4-8.4 7.4-8.4 ---	<2 <2 ---	High------ High------ ----------	0.37 0.37 ----	2	4	1-2
LoA, LoB, LoC---- Lowry	0-8 8-13 13-60	18-22 18-22 15-18	0.6-2.0 0.6-2.0 0.6-2.0	0.19-0.22 0.19-0.22 0.15-0.20	6.6-7.8 6.6-8.4 7.4-8.4	<2 <2 <2	Low------- Low------- Low-------	0.32 0.32 0.43	5	5	2-4
LrD*: Lowry----------	0-8 8-13 13-60	18-22 18-22 15-18	0.6-2.0 0.6-2.0 0.6-2.0	0.19-0.22 0.19-0.22 0.15-0.20	6.6-7.8 6.6-8.4 7.4-8.4	<2 <2 <2	Low------- Low------- Low-------	0.32 0.32 0.43	5	5	2-4
Sully----------	0-4 4-60	10-18 10-18	0.6-2.0 0.6-2.0	0.17-0.22 0.15-0.20	6.6-7.8 7.4-8.4	<2 <2	Low------- Low-------	0.43 0.43	5	4L	1-2
McA, McB, McC---- McClure	0-5 5-20 20-60	24-26 35-45 40-65	0.6-2.0 0.2-0.6 0.06-0.2	0.19-0.22 0.11-0.19 0.08-0.16	6.1-7.3 6.6-8.4 7.4-8.4	<2 <2 2-4	Moderate High------ High------	0.32 0.32 0.32	5	6	2-4
M1A, M1B, M1C---- Millboro	0-6 6-18 18-60	37-40 45-60 45-60	0.06-0.2 0.06-0.2 0.06-0.2	0.13-0.19 0.08-0.16 0.08-0.16	6.6-7.8 6.6-7.8 7.4-8.4	<2 <2 2-4	High------ Very high Very high	0.37 0.37 0.37	5	7	2-4
MmA, MmB--------- Millboro	0-5 5-18 18-60	40-50 45-60 45-60	0.06-0.2 0.06-0.2 0.06-0.2	0.13-0.19 0.08-0.16 0.08-0.16	6.6-7.8 6.6-7.8 7.4-8.4	<2 <2 2-4	High------ Very high Very high	0.37 0.37 0.37	5	4	2-4
MnB*, MnC*: Millboro--------	0-5 5-18 18-60	40-50 45-60 45-60	0.06-0.2 0.06-0.2 0.06-0.2	0.13-0.19 0.08-0.16 0.08-0.16	6.6-7.8 6.6-7.8 7.4-8.4	<2 <2 2-4	High------ Very high Very high	0.37 0.37 0.37	5	4	2-4
Boro----------	0-4 4-60	45-55 50-60	0.06-0.2 0.06-0.2	0.08-0.12 0.08-0.12	7.4-8.4 7.4-8.4	<2 <2	High------ Very high	0.37 0.37	5	4	1-3
Mp----------	0-12	20-26	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-------	0.32	5	6	4-6
Mobridge	12-30 30-60	27-35 25-32	0.6-2.0 0.6-2.0	0.19-0.22 0.17-0.20	6.1-7.8 7.4-8.4	<2 <2	Moderate Moderate	0.32 0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
Mr	0-6	7-15	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low	0.24	5	3	.5-1
Munjor	6-36	7-15	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.24			
	36-60	1-5	6.0-20	0.06-0.09	7.4-8.4	<2	Low	0.17			
Mv*:											
Munjor	0-6	7-15	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low	0.24	5	3	.5-1
	6-30	7-15	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.24			
	30-60	1-5	6.0-20	0.06-0.09	7.4-8.4	<2	Low	0.17			
Inavale	0-4	7-15	6.0-20	0.10-0.12	6.1-7.8	<2	Low	0.17	5	2	.5-1
	4-8	3-10	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
	8-60	3-10	6.0-20	0.05-0.10	6.6-8.4	<2	Low	0.17			
OhE*:											
Okaton	0-3	45-60	0.06-0.2	0.11-0.16	7.4-8.4	<2	High	0.37	2	4	1-2
	3-12	45-60	0.06-0.2	0.11-0.16	7.4-8.4	<2	High	0.37			
	12-60	---	---	---	---	---	---	---			
Lakoma	0-5	45-60	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37	4	4	1-3
	5-17	45-60	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37			
	17-25	45-60	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37			
	25-60	---	---	---	---	---	---	---			
Ok	0-20	20-26	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	6	4-6
Onita	20-36	35-50	0.2-0.6	0.11-0.17	6.1-7.3	<2	High	0.43			
	36-60	25-35	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
OlA, OlB, OlC	0-5	55-65	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4	2-4
Opal	5-21	60-70	<0.06	0.08-0.14	6.6-8.4	<2	Very high	0.37			
	21-32	60-70	<0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	32-60	---	---	---	---	---	---	---			
OmC*:											
Opal	0-5	55-65	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4	2-4
	5-21	60-70	<0.06	0.08-0.14	6.6-8.4	<2	Very high	0.37			
	21-32	60-70	<0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	32-60	---	---	---	---	---	---	---			
Chantier	0-2	60-70	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	2	4	1-2
	2-15	60-75	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	15-19	60-75	<0.06	0.04-0.06	7.4-9.0	4-16	Very high	0.37			
	19-60	---	---	---	---	---	---	---			
OnD*:											
Opal	0-5	55-65	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4	2-4
	5-21	60-70	<0.06	0.08-0.14	6.6-8.4	<2	Very high	0.37			
	21-32	60-70	<0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	32-60	---	---	---	---	---	---	---			
Sansarc	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	---	---			
OrB	0-5	15-20	2.0-6.0	0.18-0.20	6.1-7.3	<2	Low	0.24	4	6	2-4
Orton	5-30	10-20	2.0-6.0	0.14-0.20	6.6-7.8	<2	Low	0.24			
	30-60	0-7	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
OtA	0-5	18-27	0.6-6.0	0.18-0.20	6.6-7.8	<2	Low	0.24	5	5	2-4
Orton Variant	5-16	10-18	2.0-6.0	0.12-0.17	7.4-8.4	<2	Low	0.24			
	16-44	8-18	2.0-6.0	0.08-0.15	7.4-9.0	<2	Low	0.24			
	44-60	18-27	0.6-2.0	0.15-0.20	7.4-9.0	<2	Low	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
OvB*:											
Orton Variant---	0-5	18-27	0.6-6.0	0.18-0.20	6.6-7.8	<2	Low-------	0.24	5	5	2-4
	5-16	10-18	2.0-6.0	0.12-0.17	7.4-8.4	<2	Low-------	0.24			
	16-44	8-18	2.0-6.0	0.08-0.15	7.4-9.0	<2	Low-------	0.24			
	44-60	18-27	0.6-2.0	0.15-0.20	7.4-9.0	<2	Low-------	0.43			
Valentine-------	0-14	0-6	6.0-20	0.07-0.09	5.6-7.3	<2	Low-------	0.15	5	1	.5-1
	14-60	0-8	6.0-20	0.05-0.11	5.6-7.3	<2	Low-------	0.15			
Pg*.											
Pits											
PoA, PoB, PoC----	0-7	50-60	<0.06	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4	2-4
Promise	7-21	60-65	<0.06	0.08-0.14	7.4-9.0	<2	Very high	0.37			
	21-60	50-65	<0.06	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
PrA*:											
Promise---------	0-7	50-60	<0.06	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4	2-4
	7-21	60-65	<0.06	0.08-0.14	7.4-9.0	<2	Very high	0.37			
	21-60	50-65	<0.06	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Hurley----------	0-2	20-26	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	1	6	1-2
	2-60	60-70	<0.06	0.05-0.13	7.4-9.0	4-16	Very high	0.43			
ReB, ReC---------	0-10	22-26	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6	2-4
Ree	10-27	27-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.28			
	27-60	15-35	0.6-2.0	0.09-0.20	7.4-8.4	<2	Low-------	0.28			
RlA, RlB, RlC----	0-11	27-35	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
Reliance	11-27	35-45	0.2-0.6	0.11-0.19	6.1-7.8	<2	High------	0.32			
	27-60	25-40	0.2-2.0	0.14-0.20	7.4-8.4	<2	Moderate	0.32			
RsE*:											
Rock outcrop.											
Sansarc---------	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	----------	----			
SaE---------------	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
Sansarc	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	----------	----			
SbE*:											
Sansarc---------	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	----------	----			
Opal------------	0-5	55-65	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4	2-4
	5-21	60-70	<0.06	0.08-0.14	6.6-8.4	<2	Very high	0.37			
	21-32	60-70	<0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	32-60	---	---	---	---	---	----------	----			
ScE*:											
Sansarc---------	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	----------	----			
Rock outcrop.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
SeE*:											
Sansarc	0-3	55-65	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	3-15	55-65	0.06-0.2	0.06-0.12	7.4-8.4	<2	Very high	0.37			
	15-60	---	---	---	---	---	---	---			
Schamber	0-5	20-25	0.6-2.0	0.15-0.18	6.1-8.4	<2	Low	0.28	2	6	.5-2
	5-60	2-10	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
ShE	0-5	20-25	0.6-2.0	0.15-0.18	6.1-8.4	<2	Low	0.28	2	6	.5-2
Schamber	5-60	2-10	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
SlE	0-4	10-18	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low	0.43	5	4L	1-2
Sully	4-60	10-18	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.43			
VaD	0-14	0-6	6.0-20	0.07-0.09	5.6-7.3	<2	Low	0.15	5	1	.5-1
Valentine	14-60	0-8	6.0-20	0.05-0.11	5.6-7.3	<2	Low	0.15			
Wd	0-5	40-60	0.06-0.2	0.13-0.18	7.4-8.4	<2	High	0.37	5	4	3-5
Wendte	5-60	35-55	0.06-0.2	0.11-0.17	7.4-8.4	<2	High	0.37			
Wt	0-8	40-50	0.06-0.2	0.10-0.14	6.6-7.8	<2	Very high	0.37	5	4	3-5
Witten	8-24	50-60	0.06-0.2	0.10-0.14	6.6-7.8	<2	Very high	0.37			
	24-60	50-60	0.06-0.2	0.08-0.12	7.4-8.4	2-4	Very high	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AaA, AaB, AaC---Agar	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bg----------Bigbend	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
BuA----------Bullcreek	D	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
BxA*: Bullcreek------	D	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Slickspots.												
CeA----------Carter	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
ChB----------Chantier	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
FaA, FaB--------Fairlo	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Fp*. Fluvaquents												
Hm----------Hilmoe	C	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Ho----------Hoven	D	None--------	---	---	+1-1.5	Perched	Mar-Jul	>60	---	Moderate	High-----	Moderate.
HrA----------Hurley	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
In----------Inavale	A	Frequent----	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low------	Moderate	Low.
Ko----------Kolls	D	None--------	---	---	+0.5-1.5	Perched	Apr-Jun	>60	---	Moderate	High-----	Moderate.
Kp----------Kolls	D	None--------	---	---	+1.5-1.5	Perched	Apr-Jul	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
LaB, LaC--------- Lakoma	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
LbD*, LcE*: Lakoma----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Okaton----------	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low-------	High------	High.
LoA, LoB, LoC---- Lowry	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
LrD*: Lowry-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Sully-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
McA, McB, McC---- McClure	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
MlA, MlB, MlC, MmA, MmB------- Millboro	D	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
MnB*, MnC*: Millboro--------	D	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Boro------------	D	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Mp--------------- Mobridge	B	Occasional	Very brief	Oct-Jun	>6.0	---	---	>60	---	Moderate	High------	Low.
Mr--------------- Munjor	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
Mv*: Munjor----------	B	Occasional	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low-------	Moderate	Low.
Inavale---------	A	Frequent-----	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low-------	Moderate	Low.
OhE*: Okaton----------	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low-------	High------	High.
Lakoma----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Ok--------------- Onita	C	Occasional	Brief------	Mar-Oct	2.5-6.0	Perched	Apr-Jun	>60	---	High------	High------	Low.
OlA, OlB, OlC---- Opal	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
OmC*:												
Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Chantier	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
OnD*:												
Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
OrB Orton	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
OtA Orton Variant	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
OvB*:												
Orton Variant	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Pg*. Pits												
PoA, PoB, PoC Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
PrA*:												
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Hurley	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
ReB, ReC Ree	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
RlA, RlB, RlC Reliance	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
RsE*: Rock outcrop.												
Sansarc	D	None	---	---	>6.0	---	---	4-20	---	Low	High	Moderate.
SaE Sansarc	D	None	---	---	>6.0	---	---	4-20	---	Low	High	Moderate.
SbE*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	---	Low	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SbE*:												
Opal	D	None	---	---	>6.0	---	---	20-40	---	Low	High	Moderate.
ScE*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	---	Low	High	Moderate.
Rock outcrop.												
SeE*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	---	Low	High	Moderate.
Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
ShE Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
SlE Sully	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
VaD Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Wd Wendte	D	Frequent	Brief	Apr-Oct	>6.0	---	---	>60	---	Low	High	Low.
Wt Witten	D	Occasional	Very brief	Apr-Jun	>6.0	---	---	>60	---	Moderate	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate that data were not available. LL means liquid limit and PI, plasticity index]

Soil name, sample number, horizon, and depth in inches	Classification		Grain-size distribution							LL	PI
			Percentage passing sieve--				Percentage smaller than--				
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm		
										Pct	
Bullcreek clay: (SDH82SD085-4)											
A------- 0 to 2	A-7-6(20)	CH	98	97	91	86	---	59	---	64	37
Bw------ 2 to 8	A-7-6(20)	CH	99	97	92	88	---	63	---	73	47
Bkz----- 8 to 16	A-7-6(20)	CH	99	98	93	89	---	63	---	76	51
Cz------16 to 60	A-7-6(20)	CH	---	100	98	93	---	69	---	77	53
Carter silt loam: (SDH81SD085-15)											
A1, A2-- 0 to 7	A-6(10)	CL	---	---	100	98	---	60	---	39	11
Bt1, Bt2---- 7 to 13	A-7-6(20)	CH	---	---	100	99	---	48	---	66	38
Bk, Cz--18 to 60	A-7-6(20)	CH	---	---	100	99	---	56	---	61	38
Hilmoe silty clay: (SDH81SD085-10)											
Ap, A--- 0 to 11	A-7-6(8)	CH	---	---	100	97	---	48	---	54	27
C-------11 to 25	A-7-6(20)	CH	---	---	100	99	---	56	---	61	32
2C------25 to 60	A-6(10)	CL	---	---	100	76	---	24	---	35	14
Lowry silt loam: (SDH81SD085-23)											
Ap------ 0 to 8	A-4(8)	CL	---	---	100	97	---	14	---	31	10
Bw------ 8 to 13	A-6(9)	CL	---	---	100	97	---	18	---	34	12
Bk1, Bk2, Bk3, C-13 to 60	A-6(9)	CL	---	---	100	98	---	20	---	33	11
Millboro silty clay: (SDH79SD085-7)											
Ap------ 0 to 4	A-7-5(20)	CH	---	---	100	98	---	63	---	66	35
Bt1, Bt2---- 4 to 20	A-7-6(20)	CH	---	---	100	99	---	67	---	71	45
C, Cz---20 to 60	A-7-6(20)	CH	---	---	100	99	---	67	---	71	45
Reliance silty clay loam: (SDH80SD085-7)											
Ap------ 0 to 7	A-7-6(14)	CL	---	100	99	86	---	41	---	44	22
Bt1, Bt2---- 7 to 18	A-7-6(17)	CL	---	100	99	87	---	43	---	49	27
Bk, C---18 to 60	A-6(11)	CL	---	100	99	72	---	36	---	36	20

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon, and depth in inches	Classification		Grain-size distribution							LL	PI
			Percentage passing sieve--				Percentage smaller than--				
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm		
										Pct	
Sully silt loam: (SDH81SD085-24)											
A------- 0 to 4	A-6(9)	CL	---	---	100	97	---	17	---	37	12
AC, C--- 4 to 60	A-6(10)	CL	100	99	99	92	---	25	---	34	14
Wendte silty clay: (SDH80SD085-29)											
A------- 0 to 5	A-7-6(20)	CH	---	---	100	97	---	65	---	65	36
C1------ 5 to 13	A-7-6(18)	MH	---	---	100	97	---	65	---	65	26
C2------13 to 60	A-7-6(20)	CH	---	---	100	98	---	61	---	61	35
Witten silty clay: (SDH81SD085-13)											
Ap, A--- 0 to 8	A-7-6(17)	CH	---	---	100	98	---	61	---	56	26
Bt1, Bt2---- 8 to 24	A-7-5(20)	CH	---	---	100	98	---	67	---	68	38
BC, Cz--24 to 60	A-7-6(20)	CH	---	---	100	99	---	69	---	70	45

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Agar	Fine-silty, mixed, mesic Typic Argiustolls
Bigbend	Coarse-silty, mixed (calcareous), mesic Typic Ustifluvents
Boro	Fine, montmorillonitic, mesic Vertic Ustochrepts
Bullcreek	Very fine, montmorillonitic, mesic Udic Chromusterts
Carter	Very fine, montmorillonitic, mesic Vertic Paleustolls
Chantier	Clayey, montmorillonitic, mesic, shallow Typic Ustochrepts
Fairlo	Fine-silty, mixed, mesic Typic Argiustolls
Fluvaquents	Loamy, mixed, mesic Fluvaquents
Hilmoe	Clayey over loamy, montmorillonitic, mesic Fluventic Haplustolls
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
*Hurley	Very fine, montmorillonitic, mesic Leptic Natrustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Kolls	Very fine, montmorillonitic (calcareous), mesic Vertic Haplaquolls
Lakoma	Fine, montmorillonitic, mesic Typic Ustochrepts
Lowry	Coarse-silty, mixed, mesic Typic Haplustolls
McClure	Fine, montmorillonitic, mesic Typic Argiustolls
Millboro	Fine, montmorillonitic, mesic Vertic Argiustolls
Mobridge	Fine-silty, mixed, mesic Pachic Argiustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
Okaton	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Onita	Fine, montmorillonitic, mesic Pachic Argiustolls
Opal	Very fine, montmorillonitic, mesic Udic Chromusterts
Orton	Coarse-loamy, mixed, mesic Typic Haplustolls
Orton Variant	Coarse-loamy, mixed, mesic Entic Haplustolls
Promise	Very fine, montmorillonitic, mesic Udic Chromusterts
Ree	Fine-loamy, mixed, mesic Typic Argiustolls
Reliance	Fine, montmorillonitic, mesic Typic Argiustolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
*Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Sully	Coarse-silty, mixed (calcareous), mesic Typic Ustorthents
Valentine	Mixed, mesic Typic Ustipsamments
Wendte	Fine, montmorillonitic (calcareous), mesic Vertic Ustifluvents
Witten	Fine, montmorillonitic, mesic Vertic Argiustolls

Interpretive Groups

INTERPRETIVE GROUPS

[Dashes indicate that the soil was not assigned to the interpretive group]

Soil name and map symbol	Land capability	Prime farmland	Range site	Windbreak suitability group*
AaA---- Agar	IIc-2	Yes**	Silty----	3
AaB---- Agar	IIe-1	Yes**	Silty----	3
AaC---- Agar	IIIe-1	No	Silty----	3
Bg---- Bigbend	IIc-1	Yes**	Overflow----	1
BuA---- Bullcreek	VIs-5	No	Dense Clay----	10
BxA:				
Bullcreek----	VIs-5	No	Dense Clay----	10
Slickspots----	VIIIs-3	No	---	---
CeA---- Carter	IVs-2	No	Claypan----	9
ChB---- Chantier	VIs-5	No	Dense Clay----	10
FaA---- Fairlo	IIc-2	Yes**	Silty----	3
FaB---- Fairlo	IIe-1	Yes**	Silty----	3
Fp---- Fluvaquents	VIIIw-1	No	---	---
Hm---- Hilmoe	IIIs-3	Yes**	Clayey Overflow----	4C
Ho---- Hoven	VIs-1	No	Closed Depression----	10
HrA---- Hurley	VIs-1	No	Thin Claypan----	10
In---- Inavale	VIe-8	No	Sands----	7
Ko---- Kolls	Vw-4	No	Closed Depression----	10
Kp---- Kolls	VIIw-1	No	Shallow Marsh----	10
LaB---- Lakoma	IIIe-4	Yes**	Limy Clay----	4C
LaC---- Lakoma	IVe-4	No	Limy Clay----	4C
LbD:				
Lakoma----	VIe-4	No	Limy Clay----	10
Okaton----	VIe-12	No	Shallow----	10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Range site	Windbreak suitability group*
LcE:				
Lakoma	VIe-4	No	Limy Clay	10
Okaton	VIIs-6	No	Shallow	10
LoA Lowry	IIc-2	Yes**	Silty	3
LoB Lowry	IIe-1	Yes**	Silty	3
LoC Lowry	IIIe-1	No	Silty	3
LrD:				
Lowry	IVe-1	No	Silty	3
Sully	VIe-3	No	Thin Upland	10
McA McClure	IIc-2	Yes**	Silty	3
McB McClure	IIe-1	Yes**	Silty	3
McC McClure	IIIe-1	No	Silty	3
MlA Millboro	IIIs-3	Yes**	Clayey	4C
MlB Millboro	IIIe-4	Yes**	Clayey	4C
MlC Millboro	IVe-4	No	Clayey	4C
MmA Millboro	IIIs-3	Yes**	Clayey	4C
MmB Millboro	IIIe-4	Yes**	Clayey	4C
MnB:				
Millboro	IIIe-4	No	Clayey	4C
Boro	IIIe-4	No	Clayey	4C
MnC:				
Millboro	IVe-4	No	Clayey	4C
Boro	IVe-4	No	Clayey	4C
Mp Mobridge	IIc-3	Yes	Overflow	1
Mr Munjor	IIIe-7	Yes**	Sandy	1
Mv:				
Munjor	IIIe-7	No	Overflow	1
Inavale	VIe-8	No	Sands	7
OhE:				
Okaton	VIIe-8	No	Shallow	10
Lakoma	VIe-4	No	Limy Clay	10
Ok Onita	IIc-3	Yes	Overflow	1

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Range site	Windbreak suitability group*
OlA---------- Opal	IIIs-3	No	Clayey----------	4C
OlB---------- Opal	IIIe-4	No	Clayey----------	4C
OlC---------- Opal	IVe-4	No	Clayey----------	4C
OmC:				
Opal----------	IVe-4	No	Clayey----------	4C
Chantier----------	VIs-5	No	Dense Clay----------	10
OnD:				
Opal----------	VIe-4	No	Clayey----------	4C
Sansarc----------	VIe-12	No	Shallow Clay---------	10
OrB---------- Orton	IIIe-8	Yes**	Sandy----------	6G
OtA---------- Orton Variant	IIIe-7	Yes**	Sandy----------	5
OvB:				
Orton Variant----------	IIIe-8	No	Sandy----------	5
Valentine----------	VIe-7	No	Sands----------	7
Pg---------- Pits	VIIIs-2	---	---	---
PoA---------- Promise	IIIs-3	No	Clayey----------	4C
PoB---------- Promise	IIIe-4	No	Clayey----------	4C
PoC---------- Promise	IVe-4	No	Clayey----------	4C
PrA:				
Promise----------	IIIs-3	No	Clayey----------	4C
Hurley----------	VIs-1	No	Thin Claypan---------	10
ReB---------- Ree	IIe-1	Yes**	Silty----------	3
ReC---------- Ree	IIIe-1	No	Silty----------	3
RlA---------- Reliance	IIc-2	Yes**	Silty----------	3
RlB---------- Reliance	IIe-1	Yes**	Silty----------	3
RlC---------- Reliance	IIIe-1	No	Silty----------	3
RsE:				
Rock outcrop----------	VIIIs-2	No	---	---
Sansarc----------	VIIe-8	No	Shallow Clay---------	10
SaE---------- Sansarc	VIIe-8	No	Shallow Clay---------	10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability	Prime farmland	Range site	Windbreak suitability group*
SbE:				
Sansarc	VIIe-8	No	Shallow Clay	10
Opal	VIe-4	No	Clayey	10
ScE:				
Sansarc	VIIe-8	No	Shallow Clay	10
Rock outcrop	VIIIs-2	No	---	---
SeE:				
Sansarc	VIIe-8	No	Shallow Clay	10
Schamber	VIIs-4	No	Very Shallow	10
ShE Schamber	VIIs-4	No	Very Shallow	10
SlE Sully	VIIe-3	No	Thin Upland	10
VaD Valentine	VIe-7	No	Sands	7
Wd Wendte	VIw-1	No	Clayey Overflow	4C
Wt Witten	IIIs-3	Yes**	Clayey	4C

* Soils in windbreak suitability group 10 are unsuited to windbreaks.
** Only irrigated areas are considered prime farmland.

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